E ENGINEERING CONSTRUCTION WEEKLY · BRIDGES · IRRIGATION · FLOOD CONTROL · FOUNDATIONS · DAMS ·

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AUG 9 1937

Engineering NEWS-RECORD

August 5. 1937

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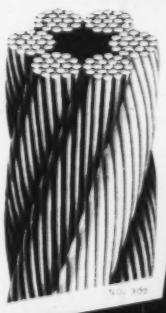
This Fatigue machine

has made it possible for Macwhyte to produce a tougher, stronger wire rope

● There are only a few of these machines in America. With th Haigh Robertson Fatigue Testing Machine, Macwhyte can measure uickly the resistance which the wire offers to repeated bending esses. Constant experiments with this machine have helped Macwhyte to develop wire with a higher fatigue resistance. This operation is typical of Macwhyte's policy of producing only high quality wire. Constant research is one of the many reasons why Macwhyte PREformed Wire Rope gives such good service.

Monarch WHYTE STRAND PREformed Wire Rope is specially designed for jobs where ropes must stand up under severe bending. Macwhyte manufactures special constructions for shovels, draglines, cableway excavators, scrapers, loaders, mixers, pavers, incline hoists. Macwhyte also makes specially designed non-preformed ropes.



MACWHYTE

PREformed

WIRE ROPE

...INTERNALLY LUBRICATED

MACWHYTE COMPANY, Kenosha, Wisconsin

Manufacturers of wire rope and braided wire rope slings

Distributors and stock throughout the U. S. A. for quick service

They Know What They Like

DURING recent weeks this writer has had occasion to discuss with a number of readers the changes in the format of this journal. Almost invariably, in the course of such talks, the advertising pages have been brought into the picture, and brought, be it noted, by the readers. This sort of thing is interesting and heartening to a publisher, for it is further evidence of a live and intelligent appreciation by his readers of the service offered to them through the advertising section.

To the advertisers, also, it must be interesting. For the publisher's share of this particular job is but to provide an effective vehicle by which the advertiser can carry his story to the readers. The use made of that vehicle and the value to be derived from it are up to the advertiser. It is his copy and presentation that must register with the readers.

At one stage in the development of advertising it was assumed that all readers were naïve creatures who, by incantation, could be moulded into acquiescence almost without their knowing it. Advertising was supposed to be the magic potion by which this spell might be cast. But so far as concerns the technical and industrial reader, "those days are gone forever."

THE READERS of a journal such as this are not guinea pigs. They are far above the average in intelligence and critical capacity. And today they are advertising-wise—far more so than is suspected by some advertising men. They know what they are looking for in advertising, what interests them and what is useful and valuable to them. They are quick to appraise what is offered: what appeals to them they accept, what does not appeal, they reject as "the bunk." Consciously or unconsciously they are turning thumbs up or thumbs down on every piece of advertising copy that passes before their eyes.

This does not mean that the reader is qualified to write the advertising or even to tell the advertising man how to do it. The concert or theater-going public is not composed of conductors or playwrights. But the public "knows what it likes." Advertising is an art to be practiced by a specialist. But the goal of every art is to accomplish its effect with the minimum of effort on the part of its object. The object of the advertising man's art is the reader; he is his public and he "knows what he likes."

From all of which it is evident that the proper study of the advertising man is the reader. This does not belittle in the slightest the importance of skillful technique. Advertising copy must live always in a competitive atmosphere; it must stop and attract the reader; it must be interesting enough in form and treatment to draw him into the message. But what of the message? There is the nub of the advertising contact. The substance of that message must take its color from the interests and tastes of those who are to receive it, not of those who send it. If the message fails, all fails.

ALL THIS may sound elementary and trite to the advertising sophisticate. But, now and again, we still hear from readers the complaint that certain advertising "tells them nothing." They ask for bread and they get ballyhoo. They are anxious to be told but they resent just being "yelled at." They grow restive under either the bald or the subtle pressure of the "mass-appeal." Advertising, they say, may be distributed in mass but it is read by individuals. They like to have some credit for knowing and understanding what they are asked to believe about the products that are offered to them.

But these occasional complaints merely reflect the widespread and increasing interest now shown by discriminating readers in the advertising pages. And that in itself is pretty good evidence that more and more advertising men who write for the industrial journals are awake to their jobs. They are talking *to* their readers and not *at* them. They are applying the first and most important tenet of their craft: if advertising is to be of any value to the seller, it must first be of interest and value to the buyer.

Willard Chevalier

ENGINEERING NEWS-RECORD

Published every Thursday. Vol. 119, No. 6. Price 25c per copy. Subscription, domestic, Canada, Mexico, Central and South American countries, $5 per year. All other countries, $9 a year or 36 shillings. Entered as second-class matter October 29, 1936, at the Post Office at Albany, N. Y., under the act of March 3, 1879. Printed in U. S. A. Cable address "McGrawhill New York." Member A.B.P. Member A.B.C.

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Editorial and Executive Offices: 330 West 42d St., New York. Publication Office: 99-129 N. Broadway, Albany, N. Y. Branch Offices: 520 N. Michigan Ave., Chicago; 883 Mission St., San Francisco; Aldwych House, London, W. C. 2, England; Washington; Philadelphia; Cleveland; Detroit; St. Louis; Boston; Atlanta, Ga.

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POWER . . . AIR . . . LIGHT

LE ROI

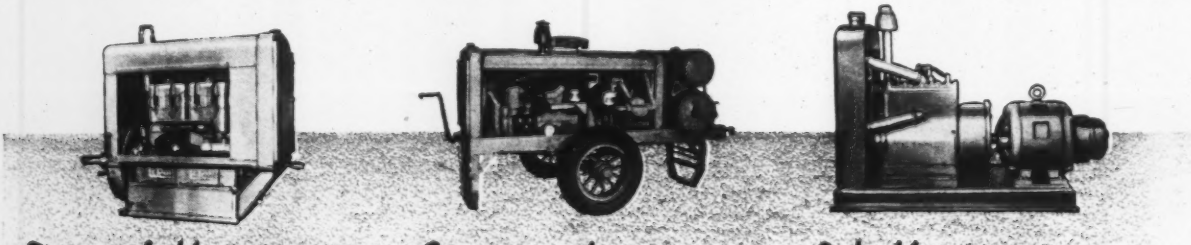
This great company presents its

CREDENTIALS

In the twenty-five years of its business life the Le Roi Company achieved a distinguished success . . . a success built upon rendering full value in the products that bear the Le Roi name.

- **More than 500 skilled engineers and mechanics are employed in the modern, spacious Le Roi plant, comprising over 122,000 square feet of floor space.**
- **Every modern tool and unit of precision machinery —for both production and thorough testing—is provided and the highest standards of precision manufacturing enforced.**
- **The purchaser of any unit of Le Roi equipment—engine, air compressor, or generating plant — is assured of value through outstanding design, select materials, and advanced standards of construction.**
- **When in Milwaukee, make it a point to visit this great plant.**

LE ROI COMPANY, MILWAUKEE, WIS.



Dependable **POWER**

Le Roi Engines, 4 to 400 H. P., the choice of the construction industry for tried, tested and proved power on all types of equipment.

Economical **AIR**

Le Roi-Rix Air Compressors. Single or two stage. Portable or stationary. All mountings. Built complete in one plant.

Reliable **LIGHT**

Le Roi direct connected Lighting and Generating Plants —1½ to 200 KW, DC or AC, any size, voltage or type—noted for silent, smooth operation and long service life.

·ENGINEERING NEWS-RECORD·

McGRAW-HILL PUBLISHING COMPANY, INC.

Editorial and Executive Offices: 330 West 42nd Street, New York · Publication Office: 99-129 North Broadway, Albany, N. Y.

F. E. SCHMITT, *Editor* WILLARD CHEVALIER, *Vice-President*

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VOL. 119 *AUGUST 5, 1937* No. 6

THIS WEEK AND NEXT

HIGHWAY LIGHTING is the subject of a group of articles that begins in this issue with an interview in which S. G. Hibben, an engineer experienced in traffic and lighting matters, surveys the present state and the future possibilities and cost of lighting our roads at night.

When exceptionally bad ground halted progress on the 110th St. sewer tunnel under East River in New York, subshafts were sunk 220 ft. deep from within the headings to carry the bore through solid rock. This unusual piece of tunneling is described in this issue.

When he set out to discover what was wrong with water utility management methods, E. G. Plowman visited more than 40 water utility systems scattered throughout the country and obtained a case history in each instance. Based on this survey he has prepared an enlightening account of management problems and their solution that begins with an article in this issue.

A new school building design in which reinforced brickwork is used has been found effective in meeting the California requirement for resistance to horizontal seismic forces.

Memphis, adopted city planning sixteen years ago to promote sound physical development in harmony with expanding needs. Specific examples of major accomplishments are described by L. P. Cockrill.

FLOOD CONTROL on the lower Mississippi by means of reservoirs on the lower Ohio and Tennessee rivers is the subject of an article by Arthur E. Morgan to be published next week. Engineers of the TVA have given extensive study to the possibility of forming a great reservoir by dams across the Ohio and the Tennessee where these two rivers and the Cumberland come together.

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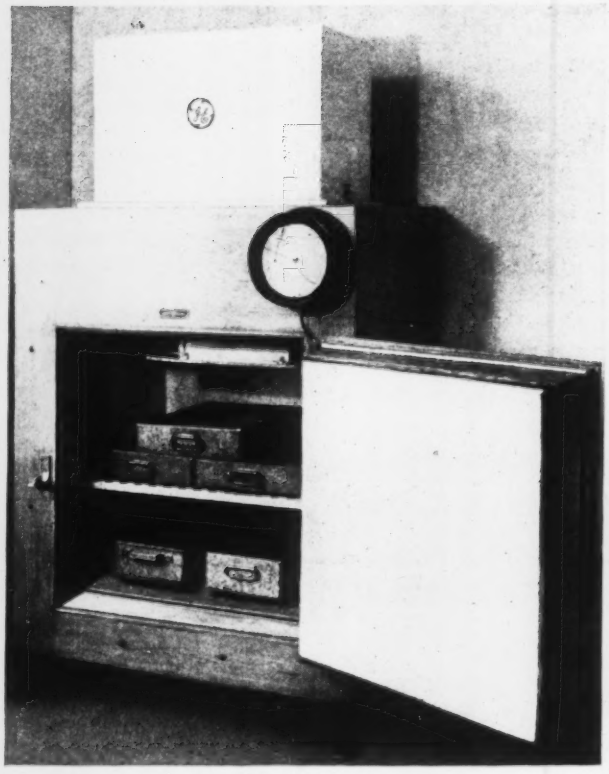
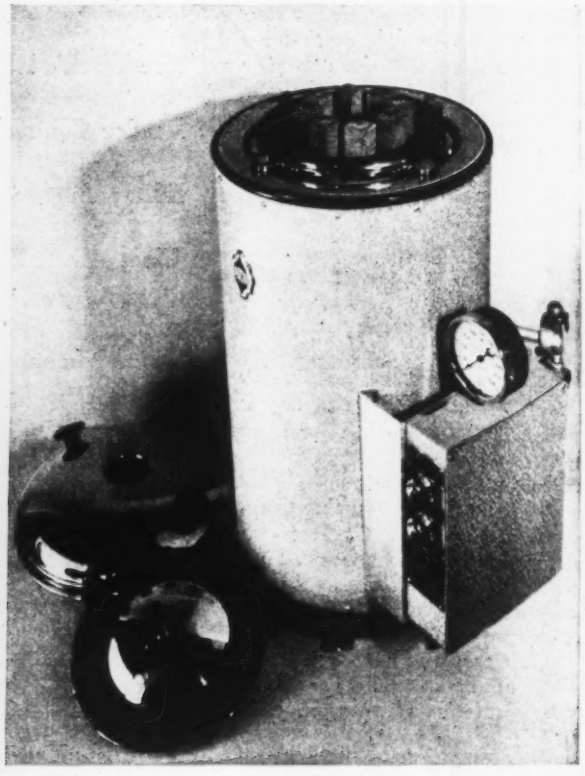
A MODERN LIGHTED HIGHWAY is shown on the cover this week to introduce the series of articles on highway lighting beginning in this issue.

Hot?... *pooh*

It's 420° in the autoclave!





THESE dog days seem *cool* when you consider the terrific heat of the autoclave.

The autoclave is the machine shown above, at the right, in which accelerated soundness tests of cement are made. Cement bars are steamed at 420°F in order to detect potential expansion, if any, years before it would ordinarily occur.

In the freezing machine, tests at the other extreme are made. In this machine, concrete specimens are alternately frozen at a temperature of 15° below zero, and thawed. The purpose is to determine in advance how the concrete will perform on the job under outdoor exposure.

This work is under the supervision of O. L. Moore, director of tests and research. Working with modern equipment, Mr. Moore directs literally millions of tests each year to insure a quality product.

The turbidimeter, using the "electric eye," makes fineness tests of cement. The modern moist cabinet cures cement mortar and concrete specimens for various periods before testing at a temperature of 70°F and a relative humidity above 95 per cent the year round.

While many of the tests made are not required by government and other standards, we figure that by being extra careful about testing, we can be extra sure of unvarying quality.

UNIVERSAL ATLAS CEMENT CO.
(United States Steel Corporation Subsidiary)
208 South LaSalle Street, Chicago
New York • Cleveland • Philadelphia • Albany
Boston • St. Louis • Des Moines • Birmingham
Duluth • Minneapolis

USS

Universal Atlas
CEMENTS

THE WEEK'S EVENTS

Wage Bill Passed By Senate

Black Bill changes child labor provisions and includes regional differentials

The Senate passed the Black wage and hour bill July 31 by a vote of 56 to 28. The bill now goes to the House, where committee hearings are in progress.

The discretion of the Labor Standards Board is somewhat limited in the final form of the bill. The board may set up a maximum work week which shall not be less than 40 hours and may establish minimum wages which shall not be greater than 40c. per hour. The wage and hour regulations of the board may take account of regional, industrial and seasonal factors.

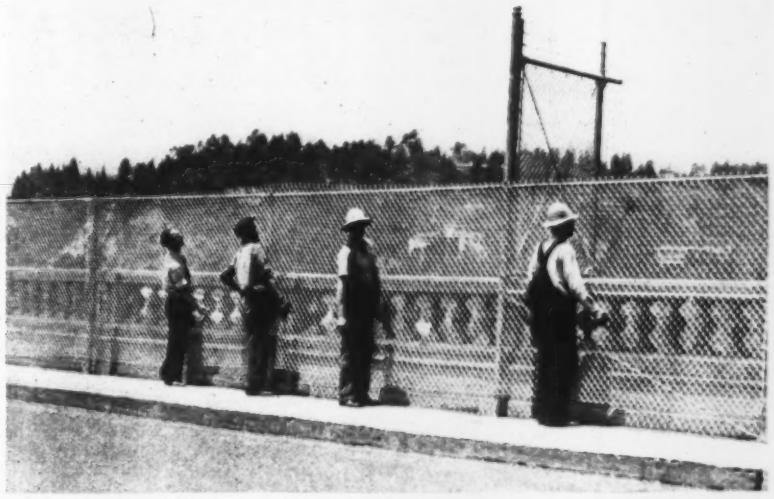
Child labor

In the closing hours of the debate on the bill the provisions regulating the use of child labor were thrown out, and a section incorporating the provisions of the Wheeler-Johnson Bill was substituted. Under the terms of this section a three-way attack is made on child labor. The transportation or sale in interstate commerce of the products of child labor is forbidden and all goods so produced must be labelled. The transportation of child labor products into states forbidding child labor is forbidden. And it is made unlawful for a producer of goods made by child labor or his agent to transport such goods in interstate commerce. It is intended that if any of these provisions are thrown out by the courts, those left will still prevent child labor.

Amendments introduced in the Senate at the last minute exempted several groups of workers, mostly engaged in work of an agricultural or seasonal nature.

The Federal Tariff Commission is authorized to make investigations of cost differentials between foreign and domestic goods with a view to determining whether additional tariffs should be passed.

It appears likely that a strong fight will be made in the House for a more stringent measure, probably permitting a maximum week as short as 35 hrs. and minimum wages as high as 70c.



Wide World Photo

YOU CAN'T DIE HERE

THIS is the wire fence being erected on the Arroyo Seco bridge at Pasadena, Calif., after 91 people had committed suicide by jumping from the bridge. The 7½-ft. woven wire fence is placed inside the balustrade on each side of the bridge, running about 60 ft. back of the main span on the approaches, and completely crossing the main bridge. Several strands of heavy barbed wire will be placed at the top of this fence. Funds for the work are being provided by the State Highway Commission.

Prequalification Set Up In Indiana

In accordance with the provisions of a law passed at the 1937 session of the Legislature, the Indiana Highway Commission has established forms of prequalification for contractors bidding on the construction or maintenance of highways. The prequalification requirement goes into effect Sept. 6.

The contractor chooses the type of work for which he considers himself qualified from among a division of ten classifications of types of highway work and receives a rating in that classification. He is required to submit a detailed financial statement accompanied by a certified audit prepared by a certified public accountant. He must also fill in an experience questionnaire.

On the basis of the information sent in, the contractor is given a maximum financial rating based on experience, equipment, and financial ability.

A contractor will not be permitted to take contracts for an amount greater than his assigned financial rating, and no contractor will be permitted to have under contract more than $350,000 at any one time, except where an individual contract exceeds that amount. In this case, only those contractors who are in the $350,000 bracket will be permitted to bid on this type of work, and only then if it is within their maximum financial rating.

• • •

Army Ordered to Study All River Basins

The House of Representatives on July 29 completed Congressional action on a joint resolution directing the War Department, through the Corps of Engineers, to prepare a comprehensive plan for flood control on all major streams in the country.

Amendments designed to add to the scope of the report by including studies of hydroelectric power development and soil conservation, added to the bill by the House committee, were lost in a parliamentary maneuver. Had they remained, the bill would have conflicted with the pending Norris bill on water control problems.

New England Pacts Opposed by F.P.C.

Power Commission holds interstate flood compacts would prejudice federal rights to power

Acting on a request from the Senate and House committees which are now studying bills consenting to interstate compacts concerning flood control in the Connecticut and Merrimac River valleys, the Federal Power Commission has drawn up letters and memoranda expressing opposition to the Congressional approval of the compacts in their present form.

The commission stated that although the compacts conform to congressional policies, set up in the flood control act of 1936, as regards apportionment of costs among the states, they constitute a radical departure from the established policy of the federal government with respect to the water power resources of the country.

The letter stated that: "The commission feels that those provisions of the compact which would work a surrender by the United States of the federal interest in the water power resources of these streams . . . and those other provisions which substitute for the present clearly defined and long established federal control over these power resources, an uncertain, indefinite and doubtful control, based upon the contingency of a possible future agreement between the United States and the tributary states, raise grave considerations of national interest which the commission believes strongly argue against the approval of the compacts in their present form."

The commission's opinion is based upon a report by the commission's general counsel in which he finds that approval of the compacts would divest the federal government of its present control over power resources in the regions affected. The general counsel's report stated:

"If the Merrimac and Connecticut Valley compacts are approved by Congress, the states signatory thereto may themselves develop the power from the projects constructed under the compacts or may provide for development by power companies or other private agencies. If the latter plan should be adopted, the signatory states will have a veto power over the national policy with respect to the disposition and use of power developed since ' . . . the terms and conditions under which any such signatory states shall make available the rights of . . . power development herein reserved shall be determined by separate agreement or arrangment between said states and the United States . . .' Under this provision . . . the federal government would not be free . . . to give the preference to municipalities and public power districts . . . which it has been the congressional policy since 1920 to provide."

• • •

Golden Gate Manager Resigns Post

James Reid, manager of the Golden Gate Bridge and Highway District, has submitted his resignation effective August 31, and the resignation has been accepted. Mr. Reid has remained in his position through a difficult period in the affairs of the district, and now that construction of the bridge has been finished he has resigned to accept an office in an unnamed industrial organization.

The district operating committee has deferred action on the appointment of a successor to Mr. Reid until Aug. 11.

A. F. of L. Agreement is Signed at Grand Coulee

Mason-Walsh-Atkinson-Kier Co., contractors on Grand Coulee Dam, announced last week that the company had signed a closed shop contract with the American Federation of Labor. The agreement provides that all employees on the dam shall be men in good standing in the appropriate A. F. of L. unions and affiliates.

About 5,500 men are now employed by the company, of whom the A. F. of L. claims about 1,100 as members of its union.

No increase in wages is provided under the agreement, which contains a no strike, no lockout provision. Employees not now members of the A. F. of L. are to be given a reasonable length of time for affiliation and all grievances between the company and the union are to be settled by arbitration. In case there is a jurisdictional dispute, the international officers of the A. F. of L. shall be final judges, the contract provides.

The agreement provides that, "all employees of this company will come under this agreement except some classes of foremen, all superintendents, timekeepers, civil engineers, warehouse clerks, messenger boys, confidential employees and office help generally."

• • •

Silicosis Claims Denied

Nine silicosis damage claims entered by workmen against Marion, Ohio, industrial concerns, seeking a total of $740,000 have been denied by the Third District Court of Appeals in Lima, Ohio. The decisions uphold a common pleas decision at Marion last spring in which it was held that the petitions do not constitute a cause of action.

ENGINEERING CONSTRUCTION CONTRACTS REPORTED BY *ENGINEERING NEWS-RECORD*, IN JULY, 1937

Engineering News-Record *reports projects of the following minimum costs: Waterworks, excavation, drainage and irrigation,* $15,000; *other public works,* $25,000; *industrial buildings,* $40,000; *other buildings,* $150,000.

Five Weeks — Thousands of Dollars (000 Omitted)

	New England	Middle Atlantic	South	Middle West	West of Mississippi	Far West	United States — July 1937	United States — Seven Months — 1937	United States — Seven Months — 1936	Canada
Public Works										
Waterworks	212	414	368	350	1,030	1,987	**4,361**	43,610	63,356	112
Sewerage	200	5,153	21	787	834	248	**7,213**	57,131	81,421	76
Bridges	1,583	4,177	1,962	1,565	2,373	868	**12,528**	74,654	103,046	387
Earthwork and waterways	101	453	169	125	2,971	1,644	**5,468**	55,739	97,823	987
Streets and roads	1,442	14,288	8,484	12,936	10,237	6,707	**54,154**	243,484	279,375	2,598
Buildings, public	856	13,097	9,227	10,668	3,609	4,244	**41,701**	197,693	291,112	521
Unclassified, public	157	25,655	412	2,255	1,699	1,217	**31,395**	96,679	61,825	709
Total public	**4,551**	**61,217**	**20,643**	**28,746**	**22,728**	**16,915**	**156,820**	**761,990**	**983,958**	**5,422**
Federal government (included in above)	332	3,494	1,415	8,266	3,495	4,883	**21,885**	114,538	171,227	
Private										
Bridges, private	.....	1,165	.....	200	69	.....	**1,365**	5,651	8,132	13
Buildings, industrial	1,891	14,953	6,550	12,833	6,581	6,674	**47,482**	337,204	150,555	5,410
Buildings, commercial	4,713	26,960	2,950	6,918	567	450	**42,558**	285,869	127,498	185
Unclassified, private	125	4,143	254	588	6,416	250	**11,776**	114,715	77,827	184
Total private	**6,729**	**45,161**	**9,754**	**20,539**	**13,624**	**7,374**	**103,181**	**743,439**	**364,012**	**5,792**
Total Engineering Construction										
July, 1937 (5 weeks)	**11,280**	**108,398**	**30,397**	**49,285**	**36,352**	**24,289**	**260,001**	.....	.....	**11,214**
June, 1937 (4 weeks)	11,034	147,787	25,705	29,859	36,226	23,788	**274,399**	.....	.....	9,504
July, 1936 (5 weeks)	15,503	71,374	31,444	37,388	44,211	26,675	**226,595**	.....	.....	21,136
Seven months, 1937	73,627	709,701	141,061	233,305	205,468	145,267	.....	1,505,429	.....	72,795
Seven months, 1936	94,224	418,781	172,507	232,228	264,724	165,506	.....	.....	1,347,970	44,459

THE CURRENT TREND

This week's news of contract volume and construction cost factors

July Holds Above Last Year

Construction volume ahead of year ago but below record June while costs continued to climb to higher levels

Engineering construction for July totaled $260,001,000, or at a weekly rate of $52,000,000 compared to $45,319,000 for the same period last year. Weekly averages for May and June this year were $58,753,000 and $68,600,000 respectively.

The July total is made up of private awards, $103,181,000; public, $156,820,000; federal, $21,885,000; compared with 4-week subtotals for June of private, $146,178,000; public, $128,321,000; federal, $20,372,000.

New construction capital came into the market in July at the rate of $52,417,000 for state and municipal bonds and $65,670,000 for corporate security issues. The $200,000,000 highway federal aid fund has been included in new capital with the beginning of the new federal fiscal year but federal appropriations for federal construction work have not been included, awaiting final Congressional action on them.

Price Changes—Lumber is $2.00 lower at Boston, Kansas City, Philadelphia and $1.00 lower at St. Louis for short leaf yellow pine. Douglas fir is $2.00 and $3.00 lower than a month ago at Boston but $1.00 higher than last month at Kansas City.

Brick prices are up $2.50 per M at Detroit. Sand and gravel prices are up 10c. a ton at Philadelphia and St. Louis. Ready-mixed concrete is 25c. higher at Philadelphia and 75c. per cu.yd. higher at Detroit.

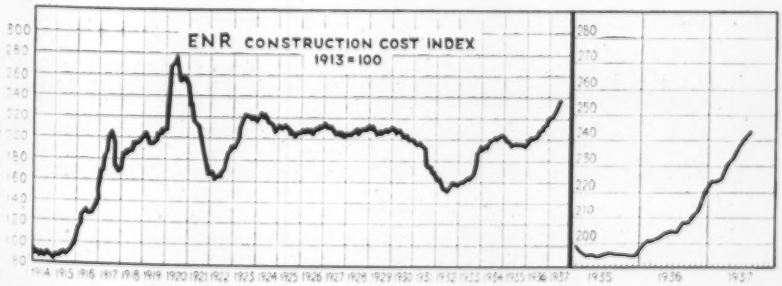
Common labor wage rates are higher at Detroit, as are wage rates for structural iron workers and hoisting engineers. Skilled labor wage rates at San Francisco are higher this month with the 6-hr. day in force for bricklayers and plasterers. At Seattle the 6-hr. day also prevails.

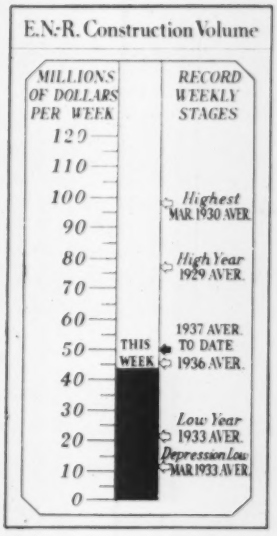
Cement—Production in June decreased 1.9 per cent and shipments increased 1.0 per cent compared with June, 1936. Stocks at mills are 24.6 per cent higher than a year ago. June shipments totaled 12,619,000 barrels compared with 11,890,000 in May.—U. S. Bureau of Mines.

Steel—Shipments of fabricated structural steel dropped slightly during June but new orders booked were much larger in volume (72.6 per cent of normal) than the average for the year (64.8). Shipments were 59.9 per cent of normal. The estimated tonnage shipped during the first 6 months, 1937, is 769,560 compared with 692,244 for 1936—American Institute of Steel Construction.

Lumber—Lumber shipments during the week ended July 24 stood at 74 per cent of the 1929 weekly average. Shipments are holding in the neighborhood of 250,000,000 feet per week.—National Lumber Manufacturers Association.

Labor—Private building jobs as reported by the U. S. Department of Labor, increased 2.8 per cent in June as compared with May, and payrolls rose 3.1 per cent according to reports from 8,942 contractors employing 121,124 workers. Compared with June, 1936, employment shows a gain of 10.2 and payrolls of 26.2 per cent.





THIS WEEK'S FIGURES

(Thousands of Dollars)

CONTRACTS

	Week Ending Aug. 6 1936	July 29 1937	Aug. 5 1937
Federal	$15,138	$ 3,918	$ 6,749
State & Municipal	23,437	22,545	21,784
Total public	$38,575	$26,463	$28,532
Total private	14,678	20,930	15,509
TOTALS	$53,253	$47,393	$44,041
Cumulative			
1937 (31 weeks)			$1,549,470
1936 (32 weeks)			$1,401,223

Note: Minimum size projects included are: Waterworks and waterways projects, $15,000; other public works, $25,000; industrial buildings, $40,000; other buildings, $150,000.

NEW PRODUCTIVE CAPITAL

	Week Aug. 5	Cumulative
NON-FEDERAL	$13,639	$931,399
State & mun. bonds	9,741	350,868
Corporate securities	3,895	338,557
PWA loans and grants		12,035
RFC loans		29,939
Fed. aid for highways		200,000
FEDERAL		57
TOTAL CAPITAL	$13,639	
Cumulative		
1937 (31 weeks)		$ 931,456
1936 (32 weeks)		$1,221,675

ENR INDEX NUMBERS

COST			VOLUME		
Base	100	1913			1913
Aug., 1937	242.95	116.78	July, 1937	185	81
July, 1937	241.75	116.21	June, 1937	245	107
Aug., 1936	208.10	100.03	July, 1936	188	82
1936 (Av.)	206.46	99.24	1936 (Av.)	185	81
1935 (Av.)	195.22	93.84	1935 (Av.)	135	58
1934 (Av.)	198.10	95.23	1934 (Av.)	114	50

The Cost Index climbs to 242.95 for August due to increase in the common labor rate average for 20 cities. A year ago it was 208.10 and the low during the depression was 152.20.

The Volume Index stands at 185 for July compared with 188 last year, a drop in physical volume of construction of 1.5 per cent, which it is interesting to compare with an indicated gain in dollar volume of 15 per cent.

What Congress Has Done

A summary of the present status of bills of engineering interest introduced during the present session.

With the first session of the 75th Congress approaching its close, the following summary of legislation affecting the engineering profession and the construction industry has been prepared. Because of the long controversy over revision of the Supreme Court, the list is unusually short; nevertheless, it contains many elements of technical importance.

For clarity the list is divided into two major parts covering (1) laws upon which Congressional action has been completed, and (2) bills in various stages of progress through the legislature. A few bills will shift from one category to the other before adjournment, but the greater number will remain as listed, since the closing days of the present session will be devoted mainly to other matters.

The fact should not be overlooked that the second session, to meet next January, will still be the same Congress and that any action taken this year will still be in effect at that time. In other words, a bill that passes one house before the present session adjourns can be enacted next year by the action of the other house only.

Bills of general interest

Passed:

Guffey Coal Act—Federal regulation of the bituminous coal industry.

Revised Railroad Retirement Act, and companion tax law.

Extension of Reconstruction Finance Corporation until June 30, 1939.

Extension of Connally Act prohibiting interstate shipment of "hot" oil to June 30, 1939.

Extension of the Civilian Conservation Corps to June 30, 1940.

Action incomplete:

Black bill setting up national wage and hour standards. Passed Senate.

Wagner bill setting up low-cost housing subsidies. Reported in Senate; no action in House.

Norris bill establishing seven regional authorities similar to TVA. Senate hearings completed; House hearings in progress.

Federal regulation of interstate commerce in natural gas. Passed by House; no action in Senate.

Limiting length of freight trains to 70 cars. Passed by Senate.

Reorganization of federal executive departments. Several bills, of which House passed one providing six assistants for President.

Repeal of long and short haul clause, Interstate Commerce Act. House passed.

Stream Pollution Bill setting up Division of Water Pollution Control in the Public Health Service. House passed.

Norris resolution directing an investigation by the Federal Trade Commission into propaganda on public ownership of utilities. Senate passed.

Navigation and flood control

Passed:

Directing the Chief of Engineers to prepare a national flood control plan.

Authorizing the Chief of Engineers to revise the Pittsburgh flood control plan as first authorized.

Same, Los Angeles County.

Same, Connecticut River.

Creating a Disaster Loan Corp. with $20,000,000 from RFC.

Permitting FHA to insure mortgage loans for flood rehabilitation.

Authorizing transfer of funds to Public Health Service for use in flood area.

Also a large number of bills authorizing the preliminary examination of various navigation and flood control projects, and permitting bridge construction over navigable waters.

Action incomplete:

River and Harbor Bill of 1938, authorizing 126 navigation projects; transferring the Central Valley project from War to Interior Departments; authorizing Marshall Ford Dam, Texas; directing pollution survey of Ohio River system by Corps of Engineers. Passed by House; reported in the Senate.

Authorizing unspecified flood control projects aggregating $24,877,000 chiefly in the Ohio Valley. Passed by House; reported in Senate.

Setting up marketing authority for surplus power from Bonneville project on the Columbia River. Passed House; Senate expected to pass.

Approving interstate flood control compacts for Connecticut and Merrimack Rivers. Reported in Senate.

Authorizing Florida Canal. Reported in House.

Public buildings

Action incomplete:

Requiring contractors bidding on public buildings to name their subcontractors and materialmen. Passed by House.

Authorizing approximately $24,000,000 army housing projects. Each house has passed a bill with minor differences; Senate will probably accept House bill in lieu of its own.

Reclamation

Passed:

Restrictions to prevent speculation in lands irrigable from Grand Coulee.

Authorizing the Arch Hurley Conservation Project, New Mexico.

Authorizing a study of the Cabinet Gorge reclamation-power project, Clark Fork of the Columbia River. In conference.

Action incomplete:

Authorizing $300,000 to investigate new reclamation projects. Passed by Senate; reported in House.

Authorizing $500,000 for small storage reservoirs in reclamation states. Passed by House; has been reported in the Senate.

Authorizing the Grand Lake-Big Thompson transmountain diversion project—reclamation and hydroelectric power. Passed by Senate; reported in House.

Appropriations

Passed:

	Millions
Treasury and Postoffice Departments	$1,503
Navy	518
State, Justice, Commerce, Labor Depts.	120
Agriculture	975
War Dept., Military	417
War Dept., Non-Military	247
Interior Dept.	133
Independent Offices	1,112
First Deficiency	949
Second Deficiency	88
CCC, Railroad Retirement, etc.	150
Relief	1,500
Social Security	18
TOTAL	$8,055

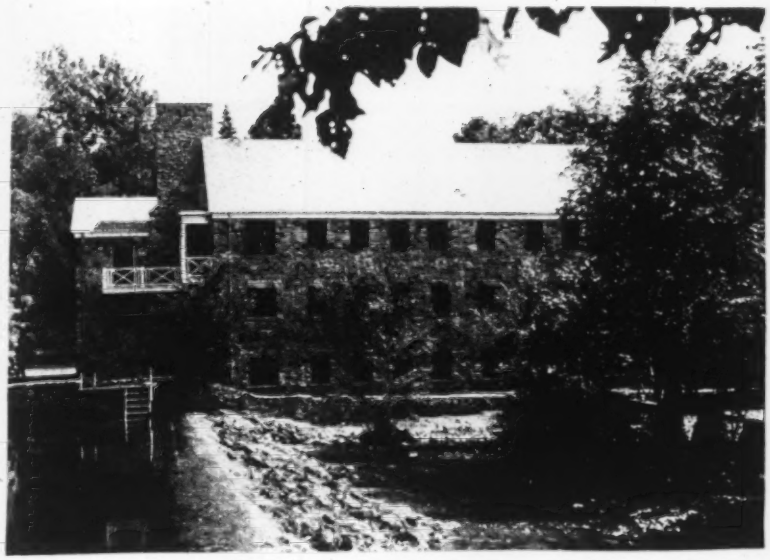
Action incomplete:

Third Deficiency Bill is still in preparation.

• • •

Additional Borrowpit Area Required at Fort Peck

In order to obtain better fill material an additional tract of land has been acquired at Fort Peck Dam west of the railroad downstream from the dam. Two dredges will work this area, reaching it through a cut to be made through the railroad fill. While the cut is being made the railroad will be shifted temporarily to the west of the new pit. A swing bridge fabricated on the job from material on hand will ultimately carry the track over the dredge cut. Four 60-ft. plate girders are being made up into a 120-ft. structure that will rotate on a pile trunnion. Hydraulic jacks will lift the swing span off its bearings when the bridge is opened, and the span will be swung by a cable hitch to a tractor.



NEW RESEARCH LABORATORY RECENTLY OPENED AT WESTPORT, CONN., BY THE DORR COMPANY

Research Lab Opened By Dorr Company

With ceremonies attended by about two hundred engineers representing the sanitary, chemical and mining professions, the new research laboratory of the Dorr Co., at Westport, Conn., was officially opened on July 30. Built on the site of the historic Westport Mill, at the confluence of the Saugatuck and Aspetuck Rivers, the new laboratory greatly extends the facilities developed by the Dorr Co. at this place during the last 20 years.

Viewed from across the millpond, the new structure, built of reinforced concrete and faced with local grey stone, retains the quaint early Connecticut appearance of the original wooden grist mill built over a century ago. Even the original headgate and tailrace are retained and are actually used for drawing large volumes of water through the laboratories for hydraulic studies.

The interior arrangement provides separate accommodations for various kinds of analytical work and includes a metallurgical laboratory equipped for all types of testing on gold, silver, copper, lead and other ores. The hydraulic laboratory in the basement is really a semi-commercial scale plant, capable of treating up to 50 tons of an ore or a chemical, and several million gallons of water a day.

Other tools of scientific research—microscopes, delicate scales, and photographic apparatus—are installed in separate rooms. A large library and a completely equipped machine shop are also included.

The conception of the "research plant in the country" is based on the philosophy of John V. N. Dorr, president of the company who believes that the logical place for scientists to work out complex problems is in quiet, peaceful surroundings rather than in the city with its many distractions. The result, he says, is a compact self-contained research community, analagous to some of the industrial villages, like Hershey, Penn, that typify the "away from the city" movement of recent years. The entire Westport Mill staff live on the 50 acres of land included with the mill property.

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Last Big Contract Awarded For All-American Canal

Award of contract for construction of the Pilot Knob wasteway puts under way the last major structure on the All-American Canal. The Pilot Knob contract was awarded to C. R. Dennis Construction Co. of San Diego, Calif., on its bid of $314,519.

The Pilot Knob wasteway, located on the west bank of the Colorado River, close to the international boundary, at the point where the canal turns west across the Imperial Valley, will regulate the flow of the canal, dumping excess water back into the Colorado River. It will be of reinforced concrete construction and will involve excavation of 517,700 cu.yd., placement of 1,830,000 lb. of reinforcement bars, and the placing of concrete and installation of machinery to operate the check and wasteway gate.

All other major structures on the all-American Canal have been put under construction and only a number of small canal turnouts, bridges and similar structures remain to be built.

Dredging Work Let On St. Lawrence

No competitive bids on $11,500,000 job or on sale of Sorel shipyard

The Canadian Ministry of Transport has announced that a contract has been awarded to General Dredging Contractors, Ltd., of Montreal, for the completion of dredging in the St. Lawrence ship channel, along the lines of the majority finding in the recent report on water levels in the channel. This indicates that the Dominion Government has accepted the findings of the Board without giving consideration to the request for economic studies of the whole matter which were made in the two minority recommendations of the board.

The expenditure involved is estimated at about $11,500,000, spread over a term of years, to be spent as allocated by the federal Parliament. A sum of $2,000,000 has been allotted for such work during the present fiscal year.

Public bids for this contract do not appear to have been called for by the department, the minister's statement including this explanation: "A contract . . . has been placed . . . at unit prices recommended by the inter-departmental board and certified by the engineering staff of the ship channel to be fair and reasonable." In other branches of Canadian public engineering work the practice of calling for competitive bids is nearly always followed.

Government sells shipyard

In connection with the announcement of this contract award, it was announced also that the federal government had decided to sell the long established government shipyard in Sorel and the fleet of dredging plant which the Government has maintained for ship channel work for many years. This establishment is to be sold to General Dredging Contractors for about $1,700,000, this sum having been arrived at "based on an appraisal of the property that has been made by a leading independent appraisal company." The property includes the large Sorel shipyard, which contains one of the largest cranes in Canada, and a dredging fleet consisting of 12 dredges, 6 tugs and about 35 barges. The minister's statement suggests that a considerable portion of the plant is obsolete and unsuitable for present use.

General Dredging Contractors is a Canadian firm headed by Joseph Simard of Sorel.

Steel Contractors Go Union

New York's leading steel erectors agree to closed shop after 32 years of resistance

Four of the larger contractors specializing in steel erection in New York City have agreed to a closed shop with the Bridge, Structural and Ornamental Iron Workers International Ass'n., an A. F. of L. affiliate, ending 32 years of resistance to such a move. The four companies, the Bethlehem Steel Co., Post & McCord, Lehigh Structural Steel Co., and Harris Structural Steel Co., individually agreed to use union workers exclusively. The unions must accept all present employees. A rise in the wage scale from $1.65 to $1.925 also became effective in July, though negotiated early last spring. Apprentices are now being paid $1.25, a raise of 25c. over the previous rate. The work week has been established at 40 hour, five days of 8 hr. each.

This action of the steel erectors eliminates the last large field of open shop construction in the metropolitan area of New York. For some time the smaller firms and general contractors who do their own steel work have worked union, but the larger companies, all members of the old Iron League, stuck to the open shop. Practically all construction in and around New York is now union.

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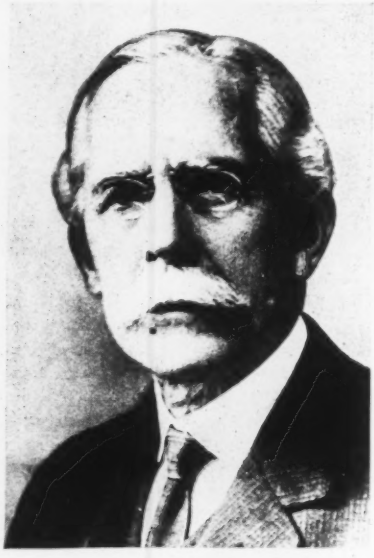
Architectural Service For Low-Cost Homes

An architectural service for homes costing under $7,500, which was begun in an experimental way without much publicity about two years ago under the auspices of the Federal Home Loan Bank Board, was formally announced last week and put into large scale operation. Lending institutions in Michigan and Minnesota met to endorse the plan, and other banking groups throughout the country prepared to take similar action, while architects and technicians in many parts of the country were being organized for the work. The plan is designed to give architectural advice and supervision on a mass production basis on homes costing less than $7,500 under sponsorship of the lending institutions providing the funds for construction.

Under the operation of the plan, the home-builder of small or moderate means will be able to approach a lending institution and gain a full home service. At a modified fee, made possible by quantity construction, he will be given architectural advice on designing a home and supervision of construction to insure proper materials and workmanship. On completion he will receive a federal certificate of registration which will guarantee the sound construction of the building and increase the resale value of the property. At the same time the lending institution will receive added protection for its mortgage.



HENRY S. DRINKER

Former Lehigh Head Dies

Henry S. Drinker, who retired in 1920 from the presidency of Lehigh University, died July 27 at Beech Haven, N. J., at the age of 87. Dr. Drinker was president of Lehigh for 15 years, had practiced as a corporation lawyer, and during his career as an engineer was widely recognized as an authority on tunneling practice.

A year after his graduation in 1871 from the School of Mines of Lehigh University, Dr. Drinker was given charge as resident engineer of the construction of the Musconetcong Tunnel on the New Jersey extension of the Lehigh Valley Railroad about 10 miles east of Easton, Pa. On the basis of his work on the Musconetcong Tunnel, Dr. Drinker published in 1878 his large work, "Tunneling, Explosive Compounds and Rock Drills," which was for many years the authoritative work on the subject and was perhaps the first comprehensive study in English of the modern development of high explosives and machine drills.

After the publication of these works, Dr. Drinker took up the study and practice of corporation law and served as general solocitor of the Lehigh Railroad Co. until, in 1905, he assumed the presidency of Lehigh.

Power Need Found By Commission

Power Commission answers charges that hydroelectric development would reduce coal market

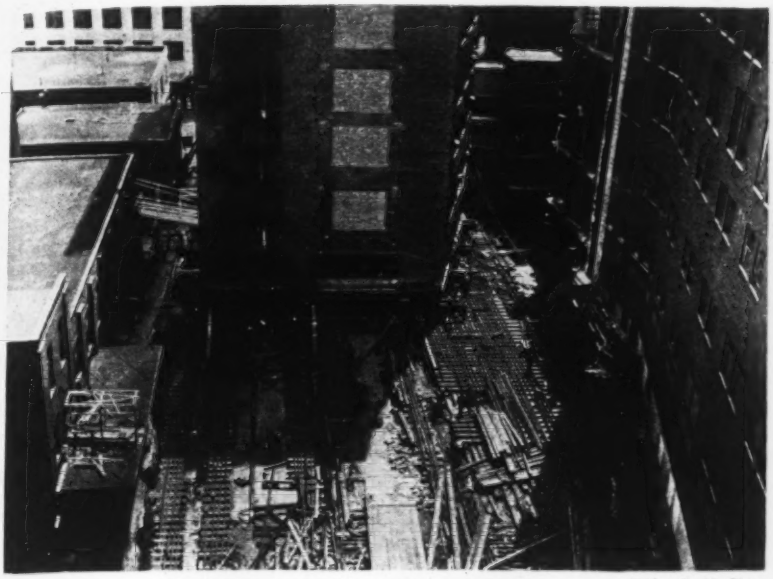
Many electric utilities are now operating without adequate reserve capacity and with no immediate provision to care for their rapidly growing loads, the Federal Power Commission reported in a letter to Senator Pope, Chairman of the sub-committee considering the Norris Bill to set up seven regional authorities for flood control and hydro electric development. The letter was sent in answer to charges made by John D. Battle, executive secretary of the National Coal Association, who stated at a hearing on the bill that figures published by the F.P.C. showed that "at the present time nowhere in the country is there any shortage of power, but on the contrary present installed capacity greatly exceeds present demand."

Denying Mr. Battle's statement, the letter says that as a result of its national power survey conducted in 1934-35, the commission found that upon the resumption of normal industrial activity shortages of power would exist in many districts throughout the United States and that the capacity of plants then existing was 2,325,000 kw. less than the demand for power that would exist upon resumption of normal activity, assuming the maintenance of a proper reserve capacity. The letter stated that the forecast then made of a demand for 104,000,000,000 kw. hr. had already been passed, and that the output of electric energy in 1936 reached 113,600,000,000 kw. hr.

Displacement of coal

Mr. Battle had also declared that development of new water power sites would have a harmful effect upon the coal industry and estimated that 199,000,000 tons of bituminous coal would be replaced by the exploitation of undeveloped water power. Analyzing this claim, the commission states that the total of coal consumed in generating electricity for public use in 1936 was only 42,025,000 tons and that in zones where the largest undeveloped water power sites exist relatively little coal is used in generating electricity.

The commission estimated that if all the undeveloped water power in regions other than the northeast and middle west, which have only 12 per cent of the nation's undeveloped water power, were exploited, it would displace a present use of only 4,856,000 tons of coal.



Wide World Photo

NINE-STORY BUILDING TAKES A WALK

NINE-STORY Brown-Thompson Building at Hartford, Conn., was moved 110 ft. to the opposite side of the block, July 25-26, while business within went on as usual, and even the elevators kept running. The actual moving operation was accomplished in 36 hours by six men and two donkey-engines, directed by J. P. Eichleay of the Eichleay Enginering Co., Pittsburgh.

Moving the building involved not only moving of 110 ft. south but also an alignment of the building on its new foundation requiring the southern end to be moved 9 in. east and the northern end 3 in. east. Water, gas and electric service were maintained in the building by flexible connections.

Williams Is Assistant Head Of Reclamation Bureau

Roy B. Williams, now construction engineer on the All-American Canal and also on the Gila project in Arizona, has been named assistant commissioner of the Bureau of Reclamation and will report to his new assignment immediately. Mr. Williams was born in Beattyville, Ky., in 1888, graduated as a civil engineer from Montana State College in 1911, and entered the reclamation service as a surveyman on the Flathead project in 1912. He has since been assigned to the Sun River and Kittitas projects and also the construction of Boulder Dam.

Mr. Williams' work in the southwest will be taken over by Leo J. Foster, formerly construction engineer for the Boca Dam on the Truckee river storage project and also the Humboldt project, with headquarters at Reno, Nev. He, in turn, will be succeeded by Charles S. Hale as acting construction engineer at Boca Dam and by Stanley R. Marean as acting construction engineer at Humboldt.

Wesley R. Nelson, who has been at Boulder Dam since 1931 with the exception of one year in the Washington office, has been appointed as chief of the engineering division in Washington. He is a graduate of the University of Southern California.

J. Kennard Cheadle, now professor of law at Syracuse University, has been named chief counsel of the Bureau and assistant to the Commissioner. He is a graduate of the University of Chicago and the Harvard law school.

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Water Company Signs Up With A. F. of L. Union

The St. Louis County Water Company has signed an agreement with Local Union 110, affiliated with the A. F. of L., representing 200 operating and construction employees. Under the terms of the agreement, operating and maintenance workers were granted a 15 per cent wage increase, and the construction men's wages were raised 15 cents an hour to 70 cents.

The agreement provides for promotion on the basis of seniority, fitness and ability, and an employee who is denied advancement may appeal to a board for examination of his qualifications. Other provisions of the contract prohibit strikes, lockouts, and espionage.

WASHINGTON HIGHLIGHTS

Special reports by Paul Wooton

A FINAL DECISION on a federal allotment for the Possum Kingdom Dam of the Brazos River in Texas is predicted by Senator Morris Sheppard of Texas, following a conference between the President's secretary, James Roosevelt, and officials of the Brazos River Conservancy District.

President Roosevelt on July 27 nominated Major Frank M. S. Johnson, Corps of Engineers, to be a member of the California Debris Commission.

Final approval has been given by President Roosevelt to a joint resolution authorizing the President to invite participation by foreign governments in the International Congress of Architects, to be held in the United States during 1939. The resolution included an authorization for the appropriation of $20,000 to defray expenses incurred by the United States.

Federal regulation of interstate commerce in goods produced under conditions exposing employees to silicosis and other dust diseases is proposed in a bill introduced July 22 by Rep. O'Connell of Montana. The bill would permit the Secretary of Labor to forbid interstate shipment of such products unless the manufacturer installs safeguards against the dust hazard.

• • •

Patent Infringement Case Lost by Milwaukee

Federal Judge Geiger has found in favor of Activated-Sludge, Inc. in its suit for patent infringement against the city of Milwaukee, the city sewerage commission and ten contractors. According to a previous decision of the court this means that Milwaukee is now liable for nearly $5,000,000. (*ENR*, July 1, 1937, p. 5). This sum represents the difference in cost between the activated-sludge process used by the city and a comparable Imhoff-trickling filter type.

The Activated-Sludge Co. will ask the city and the commission to pay damages of $3,435,000 for infringements at the original plan. Damages of $1,258,000 are claimed for infringements in connection with additional equipment and $270,000 is sought from the contractor.

(*News continued on page 242*)

COMMENT AND DISCUSSION

Readers' opinions on matters that concern the engineer

Evaporation Does Not Conserve

Sir: A. F. Meyer and A. S. Levens, in the opening paragraph of an article entitled "Determining Evaporation Losses from Weather Bureau Data" (*ENR*, April 1, 1937, p. 481), state that evaporation (from water bodies) should not always be considered as a loss but that on the contrary it represents that portion of the rainfall which is truly conserved, on the basis that all evaporation water must subsequently return as precipitation.

It was commonly believed during the seventies and eighties of the last century that the cultivation of the original sod land of the Great Plains, by increasing the evaporation opportunity, would result in an increase in the annual precipitation there. The records show the actual course of events.

Rainfall is dependent on two conditions. First, water must be evaporated into the air, and second, this water must be condensed. The authors suggested increasing the water evaporated through adding to the evaporation opportunity. But what of the second condition? Besides the evaporation opportunity there is also involved what may be called the condensation opportunity. The conditions necessary to produce condensation are created through appropriate temperature contrasts, and a favorable disposition of air masses, whose movements are generally continental in extent and beyond the influence of man.

The evaporation and condensation opportunities may not approach a condition of equality or balance in a limited area. The evaporation in any area, such as in the Great Plains, is of course, limited by available water, that is, essentially the precipitation. But the destination of such evaporated water is dependent on the movements and other characteristics of the atmosphere. It should be recognized that evaporation frequently occurs at a time and under conditions not favorable to condensation; much of this moisture taken up by the atmosphere cannot be immediately released, and tends to pass on to areas where conditions may happen to be more favorable to condensation. The place that receives the rain is that which offers the opportunity for condensation and is not necessarily the place where the evaporation takes place.

Does it assure true conservation, then, to do as the authors suggest, increase the evaporation in one place which may be of scant rainfall, whereas that water may appear in considerable part as precipitation in some other region, where the condensation opportunity exists, and rainfall is possibly abundant?

Washington, D. C. W. B. LANGBEIN
July 27, 1937 U. S. Geological Survey

Says *ENR* Libels Unions

Sir: As an engineer, and a union man, I strongly condemn your editorials "Gains by Bargaining" and "The Other Side" on p. 90 of the July 15 issue. Your characterization of unions as "exploitation by professional labor boss and mobster" is a vicious libel and will be resented by every honest and fair minded person.

In your intemperate statements you are probably presenting the viewpoint of some of your advertisers who "have exploited their technically trained employees." Unions are the one bulwark against such exploitation, and it is fortunate that many technical employees and their employers have recognized this fact.

Such statements as you have made can only serve to alienate from your subscription lists many technical men who, like myself, are concerned with their own economic welfare. I am sure that on sober second thought you will repudiate these editorials and will not, in the future, permit the use of your editorial columns as a forum from which an employer can vent his spleen because he can no longer exploit the technical man.

Brooklyn, N. Y. H. A. STEINGART
July 23, 1937

[Our comment was written after due deliberation and without dictation from anyone. It seems obvious that the easiest course would be to say nothing on a controversial subject such as unionization of engineers, because whatever is said will displease someone. However we feel that the many young engineers among our readers who are being subjected to pressure to join a union have a right to expect from us an analysis of the present situation as we see it. The arguments as to why they should join a union can be heard on any street corner.—EDITOR]

Better Concrete Mixers

Sir: Hasn't the time come when it is necessary to make improvement in the design of large concrete mixers? Since the writer made tests of the uniformity of concrete as mixed in the 2-yd. double-cone tilting mixers used in the construction of the Exchequer Dam in 1925 it has been his opinion that such mixers should be prohibited for mass concrete involving large range of aggregate size, low cement content and relatively stiff consistencies. For mixers of small size, when the concrete is rich and usually of wetter consistency, and when maximum rock sizes are small, our present mixer design may be good enough as far as the mixing operation is concerned. But for large mixers a very contrary conclusion is suggested by the performance with proportions and ingredients now commonly prescribed for mass concrete in large dams.

An excellent example of the conditions which it is believed are wrong appears in the mixers at Grand Coulee Dam described in your publication last fall (*ENR* Oct. 15, 1936, p. 546). From that article it appears that, if the stream of materials entering the mixer is well mixed, this uniformity will be maintained during the "mixing" process, but if the materials are indiscriminately placed in this so-called mixing device it is doubtful whether it would be possible to get uniform mixing within a reasonable time. When it is necessary to go to such lengths in charging as are described in the article mentioned, no further proof is needed that the equipment falls far short of proper performance of its essential mixing function.

This is in no wise a criticism of engineers in charge at Grand Coulee. On the contrary, they are to be con-

gratulated on getting such good results with equipment so obviously unsuited to their needs. They made an excellent best of a difficult situation: that is, of finding no mixing equipment on the market adequate for delivering, without undue aid, concrete of the quality and uniformity required by the specifications.

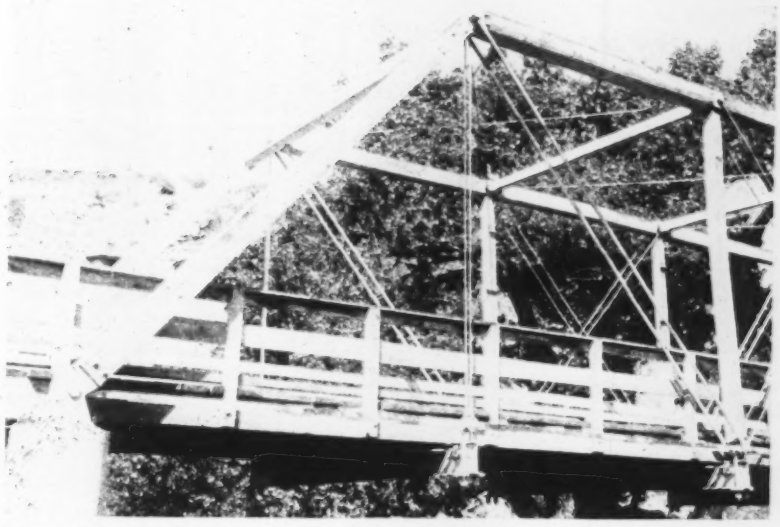
A mixer adequate for a given type of concrete in the writer's opinion, would be one into which the materials could be dumped indiscriminately and which would mix them thoroughly and uniformly in 1 to 3 min. (the time depending upon the size of the batch), and then would discharge the mixed concrete uniformly as to consistency, aggregate grading and cement content from beginning to end of the discharge. Difficulties confronting manufacturers who would attempt to meet such a requirement do not constitute a reason for not attempting solution of the problem, but so long as engineers are willing to permit the use of large mixers built along the same general design as the smaller units, often almost regardless of performance, it is quite likely that there will be little improvement. However, the manufacturer who is progressive enough to recognize this need and ingenious enough to develop a radically different mixer that will meet the requirements should be in line for a large share of the prospective business.

Banning, Calif. LEWIS H. TUTHILL
July 21, 1937 Testing Engineer, Metropolitan Water District.

Rot in Bridge Timbers

Sir: Since reading the article "Rot Causes Failure of Timber Bridge" in your June 17 issue, p. 894, I have discussed this failure with A. M. McCray, part-time county surveyor for San Benito County, Hollister, Calif. Mr. McCray designed and built this span at another site in 1908. Four or five years later the bridge was moved to the location where it collapsed. The structure had little or no maintenance during its entire life.

An examination of the collapsed bridge and another one nearby of similar design built in 1912, showed the top chords of both structures to be boxed-heart timbers with severe checking on the top face. These checks presented fine pockets for collection of moisture and rotting naturally occurred over this period of time, as indicated in your story. Side-cut timbers (those cut outside the pith) which do not so check and would not have been subject to rotting, are the recommendation of the lumber industry today for timbers in exposed locations, whether treated or not.



After collapse of a similar structure nearby, the 10x12s in this 80-ft. span, which also were boxed-heart timbers, were found to have lost about half the cross section in places by rot.

The bridge shown in the accompanying picture, built in 1912, is very similar in design to the one that failed. Both were designed for H-10 loading. The bridge here shown was closed to traffic when long delayed inspection showed that rotting of the top chord members, not apparent from the under side, had eaten away about half the cross section in places. Verticals, end-posts and portal bracing were apparently sound, except for slight decay at lower ends of verticals where they were set into cast-steel box-typed shoes.

San Francisco J. E. MACKIE
July 8, 1937 Western Mgr., National Lumber Mfrs. Assn.

Books to Afghanistan

Sir: Over a year ago I wrote the *Engineering News-Record* to ask its readers for donations for an engineering library in Afghanistan. Eleven large boxes of books were sent to me, many at the donors' expense. They were finally shipped via Karachi and Khyber Pass to Kabul, Afghanistan.

The Afghan Minister at the Court of St. James has recently written me as follows. "The Ministry of Education in Kabul have instructed me to tender to you and to the donors of the books their gratitude and appreciation of so valuable a gift. The books arrived in Kabul safely and were immediately housed in the public library there. They will prove of unbounded help and value to our students."

Will you please publish this letter as a notice to your readers of the safe arrival of their gift.

Ithaca, N. Y. M. H. WALBRIDGE
July 16, 1937 Library, Cornell University

Building Costs Not Lowered

Sir: New York's new building code, and specifically the steel section, is a material improvement on the old code, in my opinion. However, any saving through its adoption has been more than offset by increased labor costs.

The field welding permitted by the new code will probably not lead to any saving, but there are times, particularly in alteration work, when its use is very advantageous.

One particular saving in the new code is the wider use of field bolting. There is no question but what we have in the past wasted a large amount of money on unnecessary field riveting.

New York City AUBREY WEYMOUTH
July 22, 1937 Chief Engineer, Post and McCord Inc.

ENGINEERING NEWS-RECORD

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Volume 119, Number 6

Editor, F. E. SCHMITT · *Editorial Staff*, V. T. BOUGHTON
N. A. BOWERS, W. G. BOWMAN, W. W. DE BERARD
C. S. HILL, H. W. RICHARDSON, E. J. CLEARY

Editorial Offices at 330 West 42nd Street, New York

AUGUST 5, 1937

A SIMPLE PRINCIPLE underlies the critical analysis of faults in waterworks management that E. G. Plowman presents on another page. The principle is that utility service even when carried on by public agencies requires equally good business method in its administration as an undertaking conducted for corporate profit. Such utility service is in no way different from privately conducted manufacturing or service business except that the profit goes to the people at large, and there is fully as much reason for safeguarding the profits of the public by efficient administration as for safeguarding corporate profits. Fuller development of Mr. Plowman's studies in articles forming a sequel to the present one will refer to specific improvements. However, if the author did nothing more than to bring out the broad fact that poor administration results in preventable losses his studies would amply merit attention.

Power and Floods

OBJECTION TO THE FLOOD COMPACTS between the New England states has been raised by the Federal Power Commission on the ground that approval of the compacts might alienate some of the federal government's right to control power on the streams affected, this despite the fact that the compacts expressly make questions of power subject to separate agreements with the federal government. There appears but one explanation of the attitude of the commission: uncertainty in its own mind as to the reality of the right about which it speaks. By repeatedly asserting that the federal government's recognized right to control the use of waters of navigable rivers extends to the headwaters and tributaries, the commission hopes to get such extension accepted. It would spread federal control over almost every important power site. This wide extension of federal control, wholly based on the protection of navigation, has never been established, and in fact has been challenged in a case that is still in the courts. The necessity of applying it to New England rivers, with their negligible waterborne traffic, is particularly open to question. New England's water power being so valuable an asset that the states themselves can be expected to safeguard it, the synthetic fears of the power commission should not be permitted to hold up the flood-control work which the region needs for the protection of its valleys.

Directing City Growth

CITY PLANNING has fortunately outlived the incubus of the "civic beauty" ideas that grew out of the 1893 Chicago World's Fair. The tree-planting and monument-building aims which soon met vigorous public disapproval were followed by more clearly defined objectives, and in its new aspect of usefulness urban planning won public confidence progressively. It is now established in 1,500 city, county and metropolitan districts. One of the major factors contributing to this development was the recent depression, whose experiences clearly pointed the need for coordinated, planned effort in all governmental units. As outlined in this issue, Memphis has successfully employed the technique of long-term planning for sixteen years, partly to correct physical deficiencies but also, more important, to guide future growth. It is in this latter function that city planning serves best. Political administrators necessarily think in terms too short for effective results. The city planner, who looks ahead, is therefore a necessary factor in progress.

Neglect May Be Costly

CORE BORINGS to guide subsurface construction require to be conducted with care and interpreted with scrupulous attention to detail. Yet the procedure is often left to the contractor, and interpretation to the boring foreman. Competent as both may be in their trade, neither can appraise the findings as the engineer must appraise them in terms of construction possibilities and cost, stability of structure, and professional reputation. It often takes only a few inches of core negligently scrutinized to mislead the constructor and bring excessive hazard or perhaps complete disaster. In the New York sewer tunnel described on a following page the chlorite seam that necessitated an eleventh-hour change of plan represented only a fraction of a foot in several hundred feet of core length. In such a case no detail of core examination can safely be overlooked, for the consequences of neglect may be momentous. All the care with which the engineer invests his tests of the steel and concrete of his structures is doubly required in the boring tests of the rocks and earths that carry these structures.

Brick and Steel

APPLICATION OF REINFORCED BRICKWORK to the service of earthquake-resistant construction in a large school building represents the most important development to date in the young art of combining brick and steel into an efficient composite material.

The methods used to make the combination possible are fully as interesting as the design; the test strengths of brick masonry specimens and cores cut from the finished wall are so much higher than those obtained under the conventional practice of laying up brickwork that the grouting method used at Los Angeles seems to have strong claim to consideration as a superior method of construction. Together with the use of brick of special shapes and sizes to accommodate reinforcing rods and provide for their effective embedment in the cement grout, it produced a wall that combines structural strength with a satisfactory face, and does this without the complication and cost of forms. Large-sized tests of such wall construction are desirable as a verification, but on the facts already known reinforced brickwork ranks a close parallel to reinforced concrete and has similar range of use.

Road Lighting is Possible

SAFETY AND EFFICIENCY of road transport look forward to lighted highways, and highway engineers can not afford to ignore this fact. They may not continue to smother the demand for lighting with blanket statements—that the technique of lighting is not yet perfected, that financing is too difficult, or that more daylight roads are still needed. None of these statements except the last is more than partly true, but if all of them were wholly true the only point they make is that the road engineer continues to be better as technician in roadbuilding than as transportation manager.

Lighting service is called for on only a small number of our highways, less than one per cent. The limited amount needed can be managed, provided we know where to start. To answer this, *Engineering News-Record* has asked men who know to tell what has been done, and their responses are revealing. In six articles beginning in this issue these experts summarize present examples, research results, lighting principles, and design of roads for lighting. In brief, they show convincingly that road lighting is possible, both from the technical and from the financial standpoint.

Lighted highways are demanded first of all by the record of night driving accidents. Though this natural appeal to public interest is often overdone, the fact remains that night hazards are extremely serious. Whether the ratio of night danger to daylight danger is four to one or a lesser figure need not be argued, for the ratio is too great at best. Lighting is justified by accident records alone, although in the end transport economics will be the controlling influence.

Economy in transport demands a freeway by night as well as by day, and this demand will increase as commercial carriage increases. Even the individual motorist, although he does not now travel much by night, demands the right to travel as freely then as by day. Transport nowhere recognizes the hours of darkness as closed to its service, and highways must be fitted to this universal requirement. This is a task of road management.

Now that research and experiment have brought the technique of lighting and road design for lighting to the point of practical usefulness, road engineers cannot plead lack of technical means for lighting the highway. As for financial means, they can find the money in the present road users' taxes if all these funds are used for roads—the tax money diverted from road uses in 1936 would have lighted 2,400 miles of road, almost 10 per cent of the mileage that demands immediate lighting. Thus, both the technical knowledge and the money required to light major traffic arteries are in our possession; only management is lacking.

It is the task of the road engineer to provide the lacking element. If he does not, others will be asked to do it. Transport by highway will not continue to progress in the face of the preventable hazards and restrictions of darkness, and the highway engineer can find no acceptable excuse in his technicalities of design and construction.

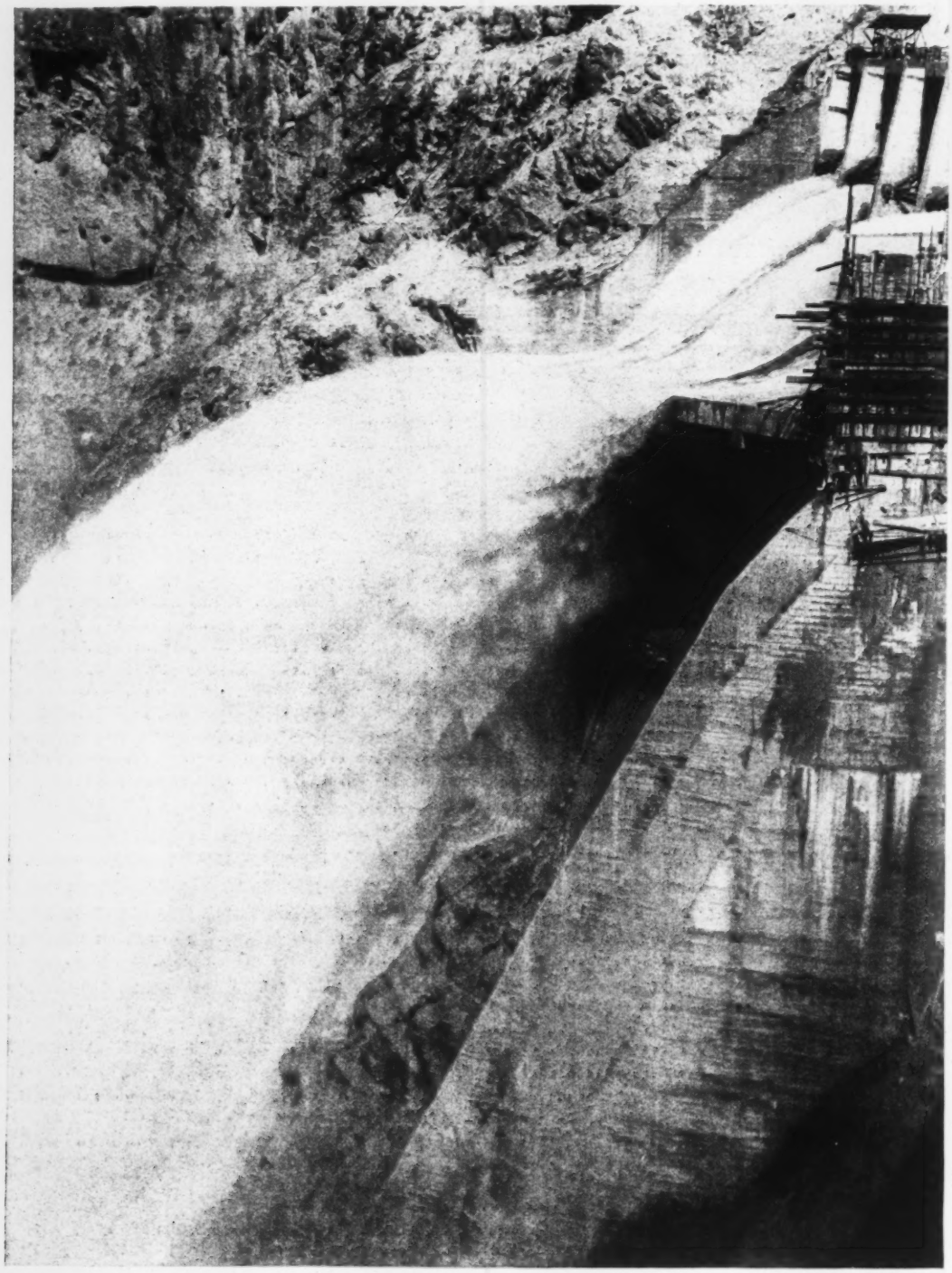
To Reclaim Housebuilding

MOST PROMISING promotion program yet devised, the home-building service plan sponsored by the Home Loan Bank Board should soon show what it can do, now that it is officially launched following a test period. The plan, whose essentials have already been described (*ENR* March 19, 1936, p. 412), loses none of its potential value by the delay in active initiation, but this value can be made real only if all the partners in building will work together—money, design, construction and home ownership.

Since all of these receive equal protection under the plan, the effect should be to take most of the wasted cost out of housing. Satisfactory location and design, good building, and a cost-plus-fair-profit price, will in turn provide assurance of quality and stabilized value, safeguards of both the home owner's and the investor's interest. While on its face the plan does not appeal to the speculative builder, it can if properly utilized prove as valuable to soundly conducted building for development and sale as to the operation of the individual owner-builder.

By its very nature the plan, when and if it comes into general practice, will undoubtedly do much to make mortgages a liquid asset. This, with the further assistance of a mortgage exchange or discount bank, should remove housing loans from the field of usury and establish them as the best type of investment the country affords.

PICTURES IN THE NEWS



Bureau of Reclamation Photo

THE SPILLWAY at Horse Mesa Dam on the Salt River in Arizona has been altered to throw the discharge clear of the canyon wall so that it falls free into the middle of the river 210 ft. below. Other pictures of the dam are on p. 243.

FIG. 1—A LIGHTED SECTION OF THE BALLTOWN ROAD, ONE OF THE LONGEST LIGHTED ROADS IN AMERICA.

What About Highway Lighting?

Questions to lighting engineer S. G. Hibben: What progress have we made in highway lighting and what are its possibilities and cost? Mr. Hibben answers

NIGHT LIGHTING of highways lies directly ahead of public-roads officials. It is full of problems. In six articles prepared for *Engineering News-Record* experts in lighting will discuss these problems. A general statement of conditions in this issue will continue with articles on present progress, laboratory experimentation and design technique. About these subjects highway engineers generally have no clear knowledge and road users are supremely ignorant.

But the question is important and should have an answer; the lighted road cannot longer be ignored in highway improvement. So to find out what the general lighting situation is, a close student of illuminating engineering, S. G. Hibben of the Westinghouse Electric & Manufacturing Co. was asked the questions that follow and his answers were taken down. They give a rather complete account of facts and one expert's views on highway lighting.

A lighting catechism

How much highway lighting has been installed on thoroughfares outside of city limits, exclusive of bridges, parks, special suburban real-estate tracts, etc.?

Short experimental sections of road have been lighted with incandescent filament and sodium-vapor lamps, most of them being at traffic circles or in congested areas. The lights have been co-operatively installed by equipment manufacturers and utilities to study types of installations and materials; they have been loaned demonstrations until recently, but outright sales for the past year or so. In the United States probably fewer than 2,000 sodium-vapor units are in service, on stretches that with three or four exceptions are less than a mile long. There are practically no mercury vapor installations, although in England no fewer than 30,000 mercury lamps have been installed, on about 1,000 mi. of highway.

Why has not the driving public been more insistent to secure highway lighting?

Possibly because no long runs of good highway lighting have been demonstrable; possibly because the public has not recognized fully the increasing hazards of night driving on dark thoroughfares; possibly also because the driving public has not been fully conscious of the diversion of gasoline taxes to other purposes, and finally, perhaps because of the

Fig. 2. The asymmetric shielded-light-source luminaire suitable for highways within the limits of large cities.

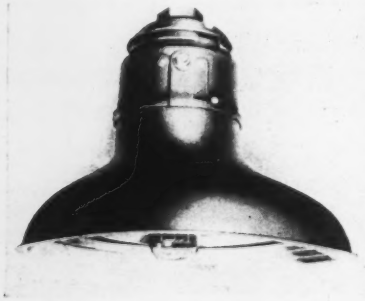


Fig. 3. Incandescent 4,000-lumen street lamp equipped with a high-visibility reflector.

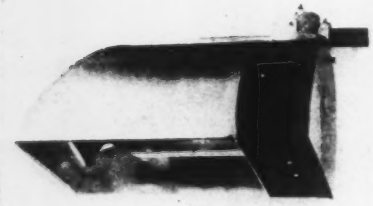


Fig. 4. Sodium luminaire of special design for lighting a traffic circle.

inartistic daytime appearance of some trial installations.

Do we know how to install good highway lighting?

Yes, technically, because one need only follow the Illuminating Engineering Society Code of Highway Lighting to be sure of a proper foundation. This code establishes spacing, mounting height, lamp size, candlepower and distribution, and the requirements for good vision; an experienced engineer can add the details that fit local conditions. Experience suggests some 22 units to the mile; perhaps 40 generated lumens to the lineal foot.

What are the best light sources today?

Probably (1) the 10,000-lumen sodium-vapor lamp supplemented by the 6,000-lumen similar unit; (2) filament lamps especially designed for exact light control, and (3) mercury-vapor units to mark dangerous traffic spots or to have other universally recognized color significance supplemental to sodium-vapor illumination.

Are we in a transition period of design which would justify postponement of purchase of equipment until the art crystallizes?

This was possibly true until a year ago but is not true today. Vapor illuminants have been rather well standardized for the service, and improved types of incandescent filament illuminants are well developed. Also reflectors and accessories have been well studied through trial installations, and so far as optical properties are concerned need not be radically changed, although only by use can perfection in detail be achieved.

Where is highway lighting needed immediately?

Probably on the most important 20,000 mi. of automobile thoroughfares, plus major new interstate arteries and all speedways roughly grouped as those carrying from 5,000 to 25,000 vehicles daily, but graded according to lanes, topography, accident history, etc.

Would not the lighting of bridges, under-grade crossings and traffic circles suffice?

This would be a forward step but would provide only flashes of bright spots and would endanger traffic just after passing these localities.

Will not improved automobile headlights solve the night-driving problem?

They will help but they will not solve the problem. On high-speed interurban arteries, if headlights are sufficient to illuminate objects at a reasonable distance they cause glare to opposing drivers. Night seeing must generally be by silhouette, and the driver's headlights will not produce a long-range luminous background. On wet nights and specular surfaces the best headlight beam would be relatively ineffective. Depressed-beam headlights on a lighted highway would greatly increase passing safety. Good headlights are necessary, but alone they cannot, on account of position, do the lighting work to best advantage.

What does a highway lighting installation cost?

About 5 to 8 per cent of the cost of constructing the highway, or less if the wiring systems may be also used for other suburban power needs. Roughly grouping together all operating costs and including capital charges of interest and amortization, a very creditable installation should be maintained in the future for between $1,000 and $1,500 per mile—for less if long stretches and extended operating times are involved.

But what about the initial investment?

Unless lighting is a federal or state undertaking, it is as yet difficult to foresee from where the funds will come to install lighting at a

Glossary of Road Lighting Terms

A ***luminaire*** is a complete lighting device consisting of a light source (lamp) together with its direct appurtenances, such as globe, reflector, refractor, housing and such support as is integral with the housing. . . The pole or post and bracket is not considered a part of the luminaire.

A ***light unit*** consists of the assembly of pole or post with bracket and luminaire.

Spacing is the distance in feet between two successive light units measured along the center line of a roadway.

Mounting Height is the perpendicular distance between grade and the center of the light source in the luminaire.

Lumen is the unit of light flux in terms of which the output of light sources is expressed.

Foot-candle is the unit of illumination and is the illumination upon a surface which receives from all light-sources, directly or by reflection, one lumen per square foot.

Candle is the unit of light intensity. At a distance of one foot, a candle produces one foot-candle (equivalent to one lumen per square foot) upon a surface normal to the beam.

cost of some $6,000 per mile. Local bond issues do not work out. Also many projects may be interstate, or extend beyond the territories of any one utility.

Who is going to pay for the highway lighting?

The motorist should bear the chief burden of costs. Probably less than 10 per cent of the present gasoline tax income (in the areas affected) would suffice for the highway lighting that is immediately needed.

Who is going to promote highway lighting—that is, who is to make it really develop?

Logically the state, so as to secure long stretches of similar treatment; the county or township is not sufficiently extensive. Also, interstate highways can be supervised as a federal function.

Can an individual public utility handle a highway lighting job in its own locality?

To a limited extent only, and satisfactorily only in the early stages of development. For example, a highway from New York to Albany would come under the jurisdiction of perhaps a dozen utility organizations, each with a different policy and a difference of rates. Perhaps a group of utility interests operating through a separate organization could sell operation and maintenance service to the state, or could uniformly handle a long stretch; at present, if we expect individual utilities or counties to function, only short and disconnected stretches would seem possible.

Why should we be interested in this matter just now—isn't it an old subject?

We have had suitable equipment only recently—really since the birth of metallic vapor lamps and the concentrated-coil type of Mazda filament lamps. Alzak aluminum and prismatic glass controls have helped to improve equipment.

How much will highway lighting influence accidents?

The records indicate that night driving is four times more dangerous than day driving, and that more than one half of the fatal accidents occur after sunset. If we assign 11,000 fatal roadway accidents to darkness (a conservative figure) we may save 5,500 with good lighting, or can conservatively translate the savings into a figure of $50,000,000 annually.

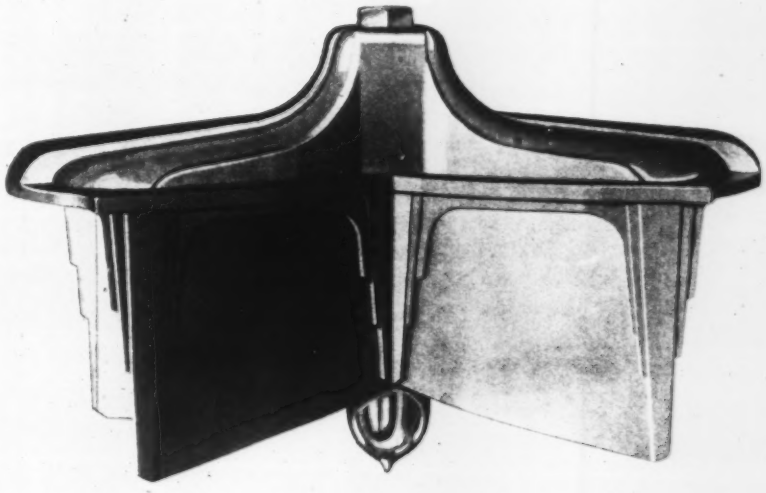


Fig. 5. Unshielded type luminaire suitable for 6,000-10,000-lumen sodium or 400-watt high-intensity mercury lamps.

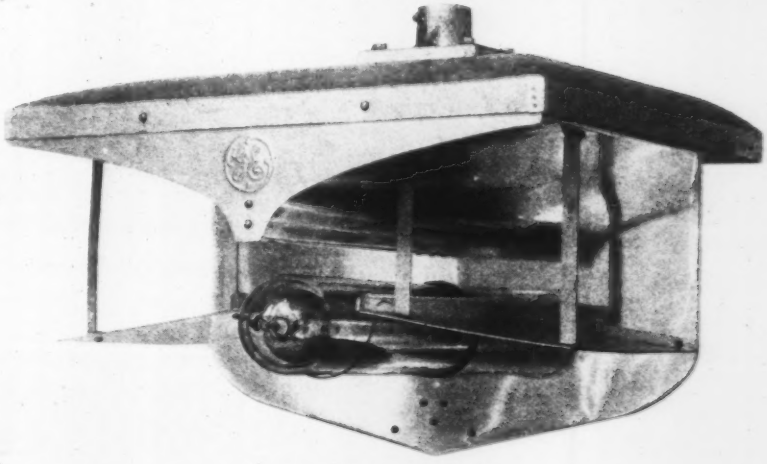


Fig. 6. Common type of sodium luminaire shown in side view.

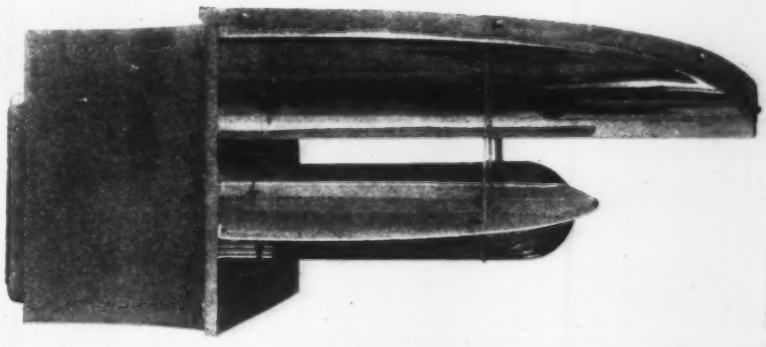


Fig. 7. Special sodium luminaire designed for the San Francisco-Oakland Bay Bridge.

How do we know that good lighting will reduce accidents?

When lighting on the Mt. Vernon highway, Washington, D. C., was turned off, night accidents increased 2½ times. On the Troy-Schenectady highway the night lighting decreased night accidents over 35 per cent at

the same time that day accidents increased about 10 per cent. Other confirming data are easily available.

Is accident prevention the only reason for highway lighting?

No, but it alone is a sufficient reason. During all wars in which the United States has been engaged—six major ones—there have been 300,000 Americans killed in battle. During the past 15 years—a period equal to the duration of these wars—more than 325,000 Americans have been killed in traffic accidents. With the fair assurance of preventing 25 per cent of these, the investment seems as profitable as a ship canal or a tidal power project.

Will highway lighting alone solve the accident problem?

No, because in conjunction with it we must have better marking of traffic lanes; delineation of edges of paving; better attention to shoulders and soft edges; divided lanes; elimination of dark paving materials, etc.

Will highway lighting reduce other traffic expenditures?

Yes. Probably it will increase the roadway capacity; it should reduce insurance rates; it may affect rural electrical service by extending distribution lines; it may slightly increase an average tax rate but should concurrently reduce other expenditures now hidden.

Editor's conclusion

So we have the general picture of slow progress; adequate design technique and lighting equipment, and a wholly undetermined plan for financing and operation.

Argument for the need of lighting is based almost wholly on its promise greatly to reduce accidents. The promise of economic gain to road transport due to 24-hours-a-day service is lightly stressed. No survey is available of the possible volume of night transport or of its economic possibilities.

In the next article, to be published Aug. 19, the road engineer will find essential data on some two-score of widely distributed road lighting installations available for personal study. He will also find plans, night views and descriptions of six installations typifying multiple lane, city entrance, traffic circle, intersection and bridge lighting.

Tunnel Looped Under a Fault

Bad rock first struck by New York sewer tunnel bypassed by sinking subshafts and dropping center section 220 ft. lower

The location on Wards Island of the 180 m.g.d. sewage works planned to serve the upper Manhattan and the Bronx sections of New York City requires a major tunnel under the East River which is now under construction by the Department of Sanitation. Designed as a rather simple drop and riser shaft siphon tunnel in rock, it met a bad fault, the hazard of which was not fully disclosed by the original borings, and change in profile became necessary after construction was well advanced. This change in plan, the conditions that made it necessary and the general construction methods employed are outlined in the article that follows. — EDITOR

ROCK CONDITIONS found in driving a sewer tunnel under the East River from upper Manhattan, New York City, have given engineers another lesson in the uncertainties of underground conditions. Geological studies and preliminary borings from the surface gave warning of a fault and bad ground near mid-river, but from the information at hand the authorities believed a tunnel could be driven 300 ft. below river level by use of some kind of soft-ground method through the fault. However, as headings from both sides neared the suspected zone, further investigation showed the fault was impassable at that level. Consequently the center section of the tunnel was dropped by subshafts from within the headings to a level 220 ft. deeper to find a clear way under the dangerous rock. The tunnel is now holed through on its complex profile. The conditions that brought about the complexity of plan and procedure and the tunneling processes employed make an unusual narrative of tunnel driving operations.

The purpose of the new tunnel is to deliver sewage from interceptors in Manhattan to the sewage treatment works on Wards Island in the East River. Essentially the structure planned consisted of a drop shaft in Manhattan, a riser shaft on Wards Island and an under-river tunnel connecting the two. When trouble began, the shafts had been sunk and the tunnel driven about 1,000 ft. each way toward the middle of the channel.

From the previous studies it was known that the headings were approaching a hazardous zone, and work was stopped pending further investigation. An exploratory core hole was driven straight ahead from the face of the Manhattan heading. In a short distance it tapped a seam carrying river water which blew out the drill, knocked over the two men operating it and shot nearly a dozen yards of material into the heading before the hole could be capped. A gage placed on the cap showed a hydraulic pressure of 135 lb. per sq.in. Following this occurrence on Dec. 10, 1936, all work was stopped until a thorough supplementary drill exploration, which took until March, 1937, could be made.

To envisage the conditions atten-

Bad ground stopped driving at the upper tunnel level, but good rock like this made fine going on the lower level, well below the fault zone.

tion is called to the sketch section, Fig. 2, of the trouble zone, and in particular to the chlorite seam shown in solid black. In planning the tunnel, diamond drill borings had been put down along the line across the river (at less than 100-ft. intervals in the critical section) and one or more of them had undoubtedly passed through this soft fluid chlorite seam on entering the firm Fordham gneiss through which the Manhattan end of the tunnel extends. As the holes topped at the surface of the river, however, it was not possible for them to indicate the fluid character of the seam; all that borings from the surface did was to show the wash from the seam, which was very small in quantity, and did not indicate at all the impassable nature of the barrier.

Geological formations

Broadly the tunnel passes through a synclinal fold in the under-river rock beds, the lowest part of the trough probably lying near the shore line of Wards Island. Under the bottom lies Fordham gneiss. Over this is a hard, altered limestone, and in the pocket formed by the dip of the limestone lies schist. The limestone reaches the surface in the river bed, where it dips to the east (toward Wards Island), and comes up again on the island, where the east shaft and a long length of tunnel at the east end pass through it. The west heading and west subshaft thus are entirely in the gneiss, while the lower tunnel passes from the gneiss into the limestone; the east subshaft rises from just east of the limestone into the schist, and the east tunnel at the 300-ft. level passes from the schist into the limestone again.

The limestone, and probably some of the gneiss and schist on either side of it, have become disintegrated under the river bed to a considerable depth, as is shown by the section Fig. 2. At a depth of 300 ft., however, experience indicated that the material would be found sufficiently impervious to permit driving, even if timbering or other mining methods were required on account of its low strength. The formation was thought to be similar to that passed through successfully by City Water Tunnel No. 2 in 1931, 600 ft. under the Bronx and East Rivers, though at one point steel sheeting had to be jacked ahead to take the ground load (*ENR*, Mar. 10, 1932, p. 361).

All idea of attempting to drive through this disintegrated region at the 300-ft. level was abandoned after the supplementary borings revealed the true nature of the material. Two distinct zones of bad ground were revealed, one about 35 ft. wide near the Manhattan heading, another some 115 ft. wide at the island side. There appeared to be no possibility of grouting this material, especially in two of the contact planes. The fluid occupying these joints was found in places to consist of exceedingly fine chlorite particles (mainly of hornblende) much finer than commercial cement. It was not believed advisable to try to displace this very fine mud with actually coarser injected cement; it probably could not be done as the mud would probably have penetrated the cement, and made the formation of any solid and watertight area around the tunnel practically impossible.

All plans changed

Solution of the problem had to take into account the fact that the shafts and a large part of the 8½-ft. connecting tunnel had been excavated. Specifically the tunnel connects a screening plant and grit chamber at 110th St. and the East River in Manhattan, which will remove heavy and coarse solid bodies from the sewage, with the disposal plant near the northeast end of Wards Island. The Manhattan end starts in rock, which had to be excavated for the grit chamber.

At the Wards Island end, 3,390 ft. distant, construction was started with an open caisson 48 ft. in outside diameter, sunk 61 ft. to rock, excavating with a 5-yd. clamshell bucket handled by a derrick. From the floor of this shaft a double elliptical shaft, containing the riser from the Bronx interceptor tunnel as well as that from Manhattan, went down about

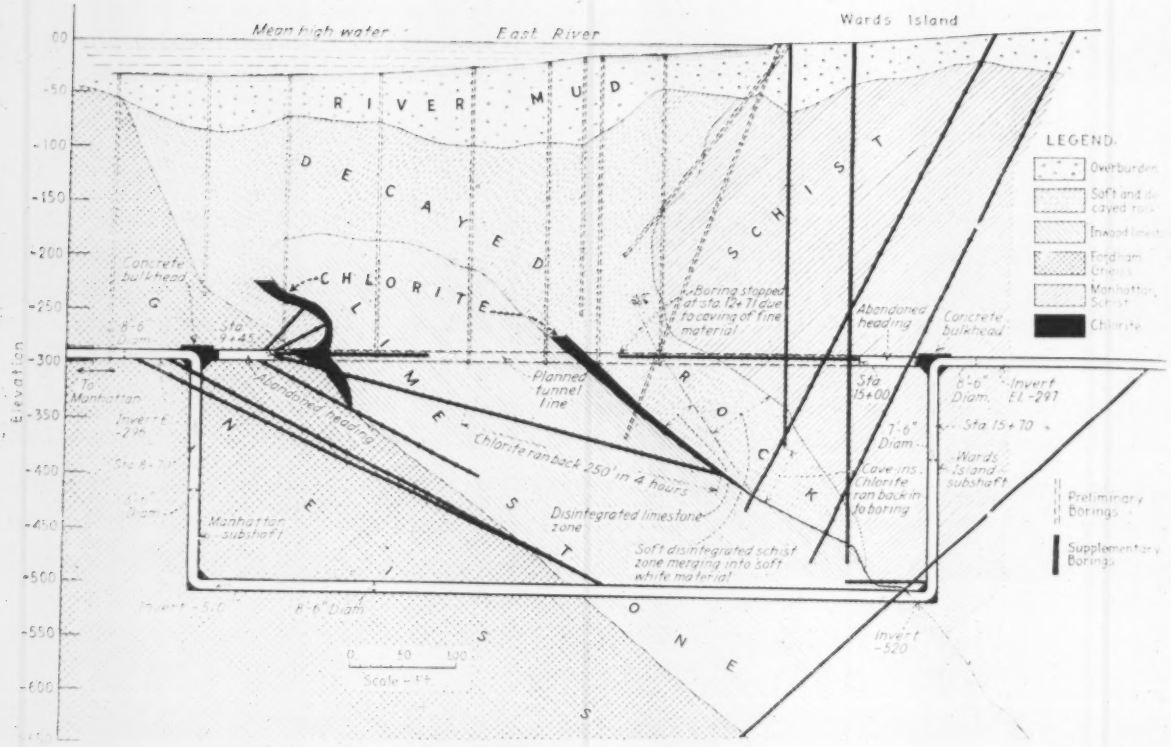


Fig. 2. When the going got too tough on the 300-ft. level of the Wards Island tunnel, the center section of the bore was dropped an additional 220 ft. to clear a zone of badly disintegrated rock and soft ground. This geological profile shows the relation of the tunnel to the various formations, the preliminary borings which failed to fully reveal actual conditions, and the supplementary borings which showed the way under the bad ground.

100 ft. deeper, to the level at which the Bronx sewer tunnel enters. Below that to the 300-ft. level an egg-shaped shaft carries the riser from Manhattan and an 8-in. line for unwatering the tunnel from time to time for cleaning. Below the cutting edge of the large caisson the shaft was sunk in rock, lined with concrete in about 30-ft. lifts as sinking progressed.

The Manhattan shaft, in rock all the way, was also lined at once, except for a section which will contain the Venturi meter. This section would not pass a hoisting cage of sufficient size, so about 15 ft. was temporarily left unlined.

From the bottom of the shafts headings were driven toward the river until the gap between them was not much longer than the disintegrated section shown in Fig. 2. The heading from Manhattan approached the doubtful rock first, and work was suspended first in this section to pursue further exploration. In fact, the first drill hole progressed only 12 ft. from the face before striking soft rock, and 35 ft. before entering the chlorite seam. When this occurred the opposite heading, still in schist, was also shut down, as a critical point had been reached, and additional horizontal and inclined exploratory holes were driven from it.

Five holes were fanned from the Manhattan heading and two additional diagonal holes were drilled from the tunnel floor behind. Besides the horizontal hole drilled from the Wards Island heading, and an inclined hole from the floor of this tunnel, two additional holes were put down on an incline from ground level on Wards Island. These holes, in addition to the original record, indicated that a tunnel at —520 ft. would pass entirely beneath the disintegrated section. But after this level was reached in the subshaft on the Wards Island end, another test hole was put through from the schist into the limestone at tunnel level, which indicated that the rock was entirely solid. This in general proved to be the case, but about 130 ft. east of the east subshaft, a soft spot was encountered in the roof which caused an overbreakage up to 8 ft., and which contained some more of the chlorite material encountered in the seam, but not in this case in a fluid state. About 20 ft. west of this, a 2-in. seam of the chlorite material was crossed, but here again it was entirely solidified.

To avoid sinking the east subshaft through disintegrated rock, it was found advisable to abandon a 70-ft. length of heading already driven out from Wards Island, and locate the subshaft 1,570 ft. from the Manhattan shaft and 700 ft. from the west subshaft. It was not necessary to backfill this heading, nor the short abandoned heading on the Manhattan side, leaving room for a hoist to serve the lower level.

Driving the bore

As replanned the tunnel was in firm rock throughout and ordinary working methods sufficed, modified only in the subshaft construction and in driving the lower level bore as is noted later. The tunnels were driven by the bench method, with two column drills in the advance heading and a horizontal column drill used

to put lifter holes in the bench. The only change from this procedure was in holing through.

The usual sequence of operations was to shoot the bench and muck out, using a mechanical shovel to load the tunnel cars while the top heading was being drilled. Track would then be extended to the end of the bench, and a platform run out over the top of the 1-yd. muck cars. The outer end of the platform was carried on a curtain-rod arrangement of two pipes of different sizes, one slipped inside the other. The ends of these pipes were slid out over dowels driven in the rock sides level with the top of the bench. The face of the top heading was then shot, and the muck wheeled back and dumped directly into the cars. These were handled six in a train, and hoisted to the surface on a cage.

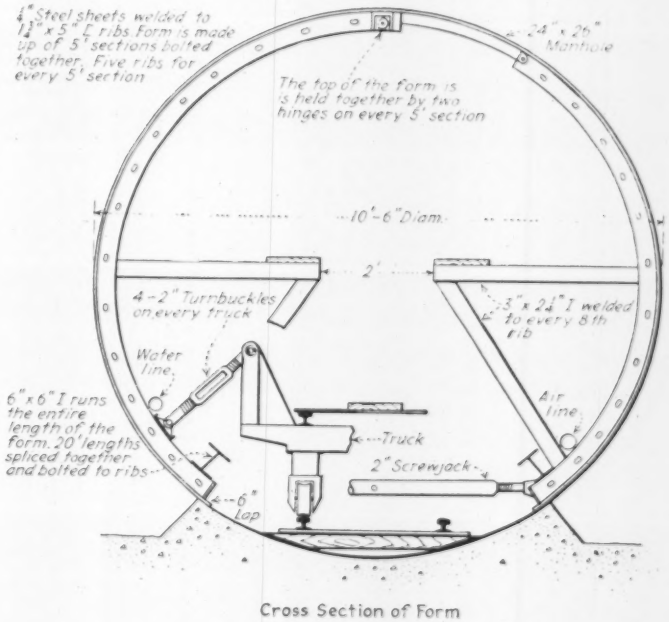
Electric storage battery locomotives were used, about six being on hand at each end, though only one or two were in the tunnel at a time, the rest being on charge. Sectional track of 2-ft. gage was laid on wood ties on the floor, and later on top of the completed invert. As it was necessary to widen the tunnel for passing sidings, these were avoided as much as possible. One was put in on the Manhattan side and one at the top of the east subshaft; and later another was put in for concreting about 150 ft. east of the Wards Island subshaft. But for mucking, an air hoist on a transverse trolley was used to pass empty cars up to the head of the train. This trolley ran on a pipe across the tunnel near the top, and lifted empties on a 4-part chain and ran them in the clear to the side. The locomotive would then pull back the loads, and the empty would be set on the track again ahead of them.

Turning now to the subshafts and the lower-level tunnel: Over each subshaft a lift was taken out on the tunnel roof about 10 ft. high, in which a head frame of four girders, carrying a single sheave, was set. The hoists were placed on the tunnel floor beyond the subshaft in each case. Muck buckets were dumped with a trip line. Sinking began March 23 last, the subshafts being lined in 50-ft. sections as they progressed. A concrete curb was run in around the top of each subshaft to 3 ft. above the tunnel floor to prevent spill from falling into the shaft. Driving the lower tunnel at the 529-ft. level began April 14, and the top headings were holed through without incident May 6, leaving some 200 ft. of bench to be removed later with hand drills. The muck buckets were handled on flat cars on the lower level, and no tunnel cars or locomotives had to be taken down.

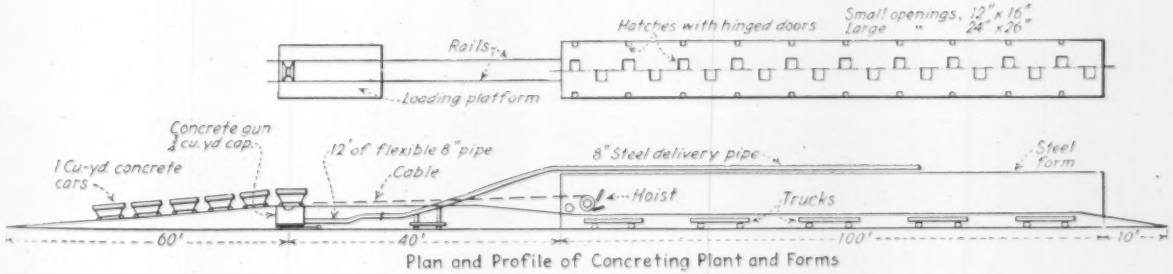
The concrete invert has been placed straight through the tunnel, except for about 100 ft. west of the subshaft on the Manhattan side. At the time this invert was concreted, work was in progress below, which it was not desirable to interrupt to remove a couple of high spots in the floor found in this section. Forms, hinged at the top in two halves (Fig. 3) and made of steel, were used to place the rest of the lining. They covered a little more than 240 deg. of the perimeter.

Lining methods

Lining was begun in the middle of the lower level, and progressed backward toward each shaft. As the Wards Island heading was the longer, a 60-ft. form was used on the east end, and a 40-ft. form on the west end. Special fabricated forms, with plates welded together at the edges, were used in making


4" Steel sheets welded to 1/4" x 5" I ribs. Form is made up of 5' sections bolted together. Five ribs for every 5' section
24" x 26" Manhole
The top of the form is held together by two hinges on every 5' section
10'-6" Diam.
2'
4-2" Turnbuckles on every truck
15" x 24" I welded to every 8th rib
Water line
Air line
6" x 6" I runs the entire length of the form. 20' lengths spliced together and bolted to ribs
Truck
2" Screwjack
6" lap

Cross Section of Form



Plan and Profile of Concreting Plant and Forms

Fig. 3. A neat concreting layout made up some of the lost time. A steady progress of 100 ft. of lining was made daily with two such plants and two sets of forms.

elbows at the top and bottom of the subshafts. Pieces as large as would pass the shafts were made up, rimmed with light angles which were bolted together below to set up the form.

The hoists were used to lower concrete cars in placing the lining. On the Wards Island side, however, this did not work well because of the small clearance in the subshaft, which is 1 ft. smaller in finished diameter than the rest of the tunnel to increase the velocity of flow for transportation of suspended matter in the sewage. On account of this difficulty, most of the concrete in the walls and roof in the east half of the lower tunnel was shot down a pipe in the subshaft. For all the lining above the invert, concrete was placed by blower through a 6-in. pipe, nothing larger than ¾-in. gravel being used for aggregate. An incline (Fig. 3) took concrete cars, of which six 1-yd. bottom-dumps were handled in trains, to a hopper at the back of the form over the blower. Incline, blower and form all rolled back on the track together. Hinged doors in the sides and near the top of the form for spading insured a smooth finish, and very little chipping or patching will be required.

While three full shifts were used in driving the tunnel, it was found best to use only two on the concrete work. Concreting is started at the beginning of the day shift, and the pour is allowed to set over the second shift, on which no work is done. The third shift is used to collapse the form, move it back and reset it. Carefully inspected commercial concrete is used, delivered in truck mixers on both sides of the river. On the Wards Island side the concrete is transferred to the tunnel cars in a circular bottom-dump bucket, while a hopper is employed at the Manhattan shaft.

Drills, pumps and concrete blowers in each heading have been operated by air furnished by a 600-ft. compressor, motor-driven, installed at each end of the work. The pumping has been negligible on the Manhattan side, where the tunnel is mainly in impervious Fordham gneiss. The limestone, however, has carried a good deal of water, and some panning was necessary in placing sections of the invert, and as much as 162 gal. per min. has been pumped from the shaft at the Wards Island end of the tunnel.

Supervision

The 110th St. tunnel is part of the extensive Wards Island sewage disposal works being constructed for the Department of Sanitation of New York City, Walter D. Binger is deputy commissioner in charge of engineering, Richard H. Gould is chief engineer and H. M. Hale is engineer of construction. Thomas McEwan is resident engineer on the Wards Island side, and B. J. Morrison in Manhattan. Diamond drilling and exploration work was done by Sprague & Henwood, Scranton, Pa. The geological studies were carried out by Dr. Charles P. Berkey of Columbia University. The George H. Flinn Corp. has the contract for the tunnel. A. Hjert, chief engineer for the contractor, is in general charge; Audrey Curtis, Edward Hoffman, Sam Allen and George Mitchell are superintendents.

The original contract carried unit price items for soft-ground driving, and the contract price was at first set up to include these units. However, the change in procedure eliminated the soft ground work, and though the subshafts were an added expense, the contract will be completed for less than the original price, according to the engineers.

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Effective Campaigning for Clean City Streets

"CLEAN UP WEEK," a common feature in many American cities and towns in the spring, has developed into a trend toward a year-round battle on rubbish. A drive for cleaner streets may be waged along three general lines, according to Stanley I. Pinel, research director of the American Public Works Association. Often all three are used together. They are:

(1) An actual clean-up campaign to collect and dispose of existing street litter, and to provide some arrangement for periodic cleaning thereafter;

(2) A drive to enact and enforce ordinances requiring property owners and householders to keep premises and sidewalks clean, and to make it illegal to throw litter on a street or sidewalk;

(3) A preventive compaign to gain the cooperation of all citizens to avert the littering of streets.

"Of the three," says Mr. Pinel, "the preventive campaign is usually the only kind that has any lasting benefit. Schools in particular, civic clubs, churches, movies and newspapers have been enlisted by cities successful in such activity. This kind of campaign, naturally, must be conducted over a rather long period; in fact it should be more or less continuous and eventually become a regular part of school activities."

A number of cities have anti-litter ordinances, which prohibit dumping on sidewalks, streets and vacant lots of specific kinds of refuse, from Christmas trees and grass cuttings to worn-out automobiles or parts. Some cities impose fines as high as $50 or $100 for violations, but $5 and $10 are the usual penalties. Since 1932, May in Minnesota has meant clean-up month for all cities, by order of the State Board of Health. Newspaper notices request citizens to brush up yards and sidewalks. Other cities, waging campaigns of a week's duration, report accomplishment by appointing block captains in school civics classes, to report careless disposal of rubbish; or women supervisors are appointed to check undue untidiness of premises in various sections.

Manchester, England, conducts a clean-up week each year utilizing a variety of means to call attention of citizens to civic duty. Besides the usual public posters and radio talks, news of the city-wide clean-up appears on bookmarks which are handed out with each library book; gas bills and milk bottle caps may carry labels stressing the subject; a traveling news sign repeats slogans in the public square; loud-speaker vans move about the city calling attention to those who throw litter into the gutter instead of placing it in baskets; and the city finances a 7-min. film, "Let's Talk Rubbish," through which the sanitation department can explain its concern for neatness to the movie-going public.

What's Wrong In Waterworks Management

by E. Grosvenor Plowman
Denver, Colorado

Weaknesses in municipal water utility management may be attributed to complete charter restrictions, departmental over-functionalization, and the influence brought by perversive public opinion

From the practical background acquired as executive assistant to the Denver Board of Water Commissioners for several years, and with data compiled from a field survey of water utilities in more than 40 cities, the author has prepared a revealing account of management weaknesses in one of our most important municipal services. In an article to follow the close relationship that exists between organization and management is discussed, and a concluding article sets forth tested methods of sound administrative practice. — EDITOR

WHEN something goes wrong in our municipal waterworks' system, we are prone to pin the blame on some one person. We clamor for his dismissal and demand that the water utility be taken out of politics. In truth, faulty organization is far more often the root of our temporary discomfort.

Even water utility executives sometimes fail to see this subject of faulty organization in its true light. Each detailed management problem is, to them, a separate and distinct experience. Furthermore to criticize organization, however constructively, is to plunge into the deep water of local politics. The utility executive feels safer on the dry land of "things as they are."

These weaknesses in the organization basis for water utility management may be arranged in three general groups. First in importance are the detours introduced at the highest management level by most city charters. Growing out of this closely defined legal pattern of laws, charters and ordinances are the management weaknesses and defects due to over-functionalization. Very different but no less important are the handicaps and costs incident to necessary and often praiseworthy catering to the whims and requirements of public opinion.

Private business, especially the privately-owned public utility, is increasingly subject to handicaps resembling the management weaknesses of the municipal water utility. Before lifting the finger of scorn private business executives should question to what extent their more fortunate position is due to chance. To date little attention has been paid by anyone to the vast field of business organization in publicly owned utilities.

Results of detours

When a city takes over or creates a municipal water utility, but denies it independence of organization, detours are introduced. A water utility is an economic whole, having functional unity. Its dismemberment can be accomplished only by adding expense and wasting time.

Thus Baltimore, generally regarded as well-managed, has many such time-wasting and costly detours. The water department, so-called, consists of the activities of pumping, filtration, purification, routine engineering, routine construction and maintenance and handling of customer complaints. Other divisions of Baltimore's city government, separate from each other and independent of the water department, are responsible for legal counsel, funds deposit and disbursement, auditing, civil service administration, purchasing, major construction, and billing and collecting.

Most of the water utilities of this country follow this curiously complex pattern, due to the attempt of city charter draftsmen to obtain the relatively unimportant and elusive economies of city-wide legal counsel, accounting and purchasing, or to pour all city business into some pre-conceived pattern. This decentralization process makes it impossible to hold any one person or even any one group responsible for successful management. And by the same token it is equally impossible to give anyone the necessary authority to promote successful management."

The New York water utility consists of three main and separate parts, namely, a project construction organization, an operating organization and a billing and collection organization. It seems probable that New York's recent deficit and rate-raise experiences might have been less troublesome had there been a single responsible management unit between the public and the water utility.

Cicero, Ill., a Chicago suburb, took strong steps in 1933 to eliminate an annual water deficit due to failure of employees to read meters, failure of meters to register at all because of faulty maintenance, and excessive system leakage resulting from faulty maintenance. This condition could not have developed if the Cicero water utility had not been organized with management detours of the sort described. A single responsible management could not have overlooked the relation between income, expense and operating efficiency.

Houston has long possessed for its water utility an aggregation of accidentally related wells and pipe systems, each one the result of some suburban annexation. A recent court decision reserving water income for water utility use, reveals one of the detours underlying Houston's management weakness.

A small minority of all water utilities (but constituting a majority of

the larger metropolitan enterprises) have eliminated some or all of these management detours. This has been done by creating a city-manager, water-board or utility-district form of top organization.

There are fewer detours under the city-manager form of government in such cities as Cincinnati, Oklahoma City, Dallas and Sacramento, because the manager is responsible for, and has authority over, the entire water utility. He recognizes the economic unity of the water enterprise and, therefore, he has a pronounced interest in avoiding red-tape detours. His success in this regard depends more upon himself and the support he is given by the community than upon actual change in organization. Perhaps lack of support is why, in San Diego, the city manager seems to have made little progress toward improved water utility organization.

The water boards of such metropolitan cities as Erie, Des Moines and Louisville are a step beyond the city-manager form of organization. This is because less depends on the human factor. Creation of a water board is itself a declaration against detours in management and for unitary control and responsibility. However, water boards such as those of Detroit, Denver and Los Angeles are still tied close to the mother city. This too-close relation results in management detours such as city-wide legal counsel, accounting or purchasing. It opens the door to bickering over such questions as payment for water used by the municipality itself.

The ideal water utility structure, from this standpoint of centralized and efficient organization, is the utility district. Such agencies function in Omaha, San Antonio, San Francisco, Oakland and the Maryland suburbs of Washington, D. C., with success comparable to the best practice of private business. The utility district, as used in the Boston and Los Angeles Metropolitan areas, has proved itself the only way to organize for wholesale distribution of water to several municipalities.

Over-functionalization

Just as thoughtlessness about organization introduces wasteful detours, so it leads to over-functionalization as well. All municipal business tends to be functionalized. By charter or ordinance this office or that is created to meet a certain need. This functionalization when overdone becomes a management weakness.

Purchasing is a good example. Was the cause of efficiency and good management actually served when the new San Francisco charter centralized all city purchasing? What probably happened is that the water department and the purchasing department were forced into relations with each other, involving records duplication and innumerable conferences and compromises. Perhaps the water department will be forced to increase its stocks of materials, or expand its own shop activities to offset new delays and difficulties.

Our municipal water utilities display three characteristic management weaknesses:
They contain complex and costly detours introduced into their organization chiefly by charter draftsmen.
They are often beset with the tangled problems of over-functionalization, where charters, courts and city attorneys have laid down impossible requirements that are obstacles to clear-cut allocations of activities.
They cannot, in general, withstand the pressure of public opinion, even when it is wrong. Hence they plunge into premature expansion or hold back necessary management reforms.

Accounting is another good example. When substantially parallel sets of books are kept by a water department and city auditor, as seems to be done in Detroit, does over-functionalization pay?

Over-functionalization, as written into city charters, tends to force the water department into duplication of records in order to keep essential data in its own files. It often leads also to jurisdictional disputes with other branches of the city government. In Denver such a dispute has smoldered between water department and park department over the maintenance and operation of the city ditch. The ditch, a raw-water carrier of interest only to the park department, was transferred to the water department to comply with the over-functionalized concept that no other department in the city government could control any city water right.

Catering to the whims and requirements of public opinion is an important contributor to management weaknesses. Such catering abuses may best be illustrated by means of typical examples:

Sacramento—Here the water utility management has been unable to eliminate its annual deficit because the public has commanded its executives, in the city's charter, never to meter residential water users.

San Francisco and East Bay—On the two sides of the bay two separate agencies have expensively overbuilt their respective water collection systems. Attempts to pool efforts failed, presumably because of local pride.

Denver—A new water supply is being developed partly because the public resents regulation of sprinkling use and is presumably opposed to metering.

San Antonio—Ten minor rate reductions have recently been made on an already low base, in response to public agitation.

Chicago—Metering is proceeding after a delay of more than 20 years, because the public did not wish to be restricted.

Detroit—The city refuses to pay for municipal water, and, in addition, it occupies part of the water-utility office building rent free!

Illustrations of this kind can be multiplied from almost every city in the country. They show that public opinion is at the bottom of many obvious management mistakes and weaknesses.

In summary, our municipal water utilities display three characteristic management weaknesses: (1) They contain complex and costly detours introduced into their organization chiefly by charter draftsmen; (2) They are often beset with the tangled problems of over-functionalization, where charters, courts and city attorneys have laid down impossible requirements that are obstacles to clear-cut allocations of activities; and (3) They cannot, in general, withstand the pressure of public opinion, even when it is wrong. Hence they plunge into premature expansion or hold back necessary management reforms.

The second article by Mr. Plowman, to be published in a subsequent issue, outlines effective organization methods.

Brick School Built Earthquake-Resistant

by CHAS. H. FORK
Structural Engineer, Los Angeles, Calif.

New design, used in Vermont Ave. School at Los Angeles, develops maximum rigidity and meets California's seismic requirements for lateral resistance

REINFORCED BRICK construction, though not in itself new, has been adapted to meet new and more stringent requirements in the design of the Vermont Ave. School at Los Angeles, with the result that this structure represents an improved type rigid enough to resist earthquake shocks while at the same time giving the pleasing exterior finish and appearance obtained with brick.

This new school building is the first result of a special study which the author was commissioned to undertake last year for the Clay Products Institute of California. The objective was to develop a design for reinforced brick masonry school buildings that would conform to California's laws on earthquake resistant buildings, namely, that in addition to all requirements for gravity loads the structure must be able to resist 10 per cent of these loads applied to the building laterally in any direction.

The result of the study was a design for the Los Angeles school which was approved by the California Division of Architecture. Construction of the school recently has been completed. The structure has walls of reinforced brick masonry with floors and roof of reinforced concrete. In short, it embodies a combination of materials arranged to obtain the maximum advantage of each. The building consists of three parts; a one-story unit in front flanked by east and west wings each two stories high. The floor area is 38,700 sq.ft.; the building cost totalled $180,000 or $4.62 per sq.ft. of floor area.

Framing plan

To meet seismic requirements a definite path is provided for transferring horizontal forces to the ground. For this purpose the internal and external walls plus the floor and roof slabs are designed as a frame capable of resisting horizontal forces from any direction. For a transverse horizontal force the longitudinal walls become vertical beams and are designed as such; the floor slabs are designed as horizontal girders carrying accumulated forces to transverse walls which function as vertical cantilevers transferring accumulated lateral forces to the ground. Similar reasoning holds, with correspondingly different walls functioning, when it is assumed that horizontal forces are applied in a longitudinal direction.

As all walls were designed to resist lateral forces and to support gravity loads, resultant stresses generally were low. Only in a few cases did the stresses reach the following values: direct compression, 175 lb. per sq.in.; combined direct and bending stress, 292 lb. per sq.in.; shear 37 lb. per sq.in.; bond, 68 lb. per sq.in.

All exterior and interior walls are bearing walls and have an effective thickness of 13 in. for the entire height. In spandrel beams, the principal continuous steel is placed near the top and bottom, making the full depth available for beam action; piers are treated in the same manner, making the wall as a whole function as a continuous frame and enabling it to resist either tensile or compressive stress. Brickwork begins on the spread footings of concrete into which key bricks are set while the concrete is still wet. These keys project above the concrete surface and thus resist shear along the joint plane.

In pouring concrete floors and roof, joist-and-slab construction was used with pans 30 in. wide and 12 in. deep. The joists were set on 30-in. centers and were given a 3-in. slab covering.

Three brick shapes

Departures from standard practice in the brick walls were (1) the use of specially shaped brick or brick "units" to provide channels for grout around the reinforcement and (2) the development of a technique for filling the interior joints with grout. The first of these required the use of three different brick shapes, namely, the standard $2\frac{1}{4}$x$3\frac{3}{4}$ x8-in. unit for general filler purposes, the three-quarter unit to provide a vertical groove affording grout space for the vertical reinforcement and the one-half or narrow unit to provide a horizontal groove affording grout space for horizontal reinforcing. Arrangement and use of these units are indicated in Figs. 2 and 3. The grout channels brought the reinforcement nearer the face of the wall and thus increased its effective depth. Also, the increased grouting space improved bond between steel and masonry. With the three-quarter brick unit the bar spacing no longer need be in multiples of a brick dimension. If this unit, when laid in the usual manner, does not clear the limit of the desired groove space or channel, the unit is reversed, moving the channel 4 in. forward.

A simple three-quarter unit provides a 4-in. vertical groove; two together make an 8-in. groove. The half-units simply leave one half the course width for use as a horizontal groove. As an aid to the bricklayers it was found preferable to use a spacing of 2 ft. 2 in. for the vertical bars wherever possible and a spacing of 2 ft. for horizontal bars. Where more steel area was needed, either the

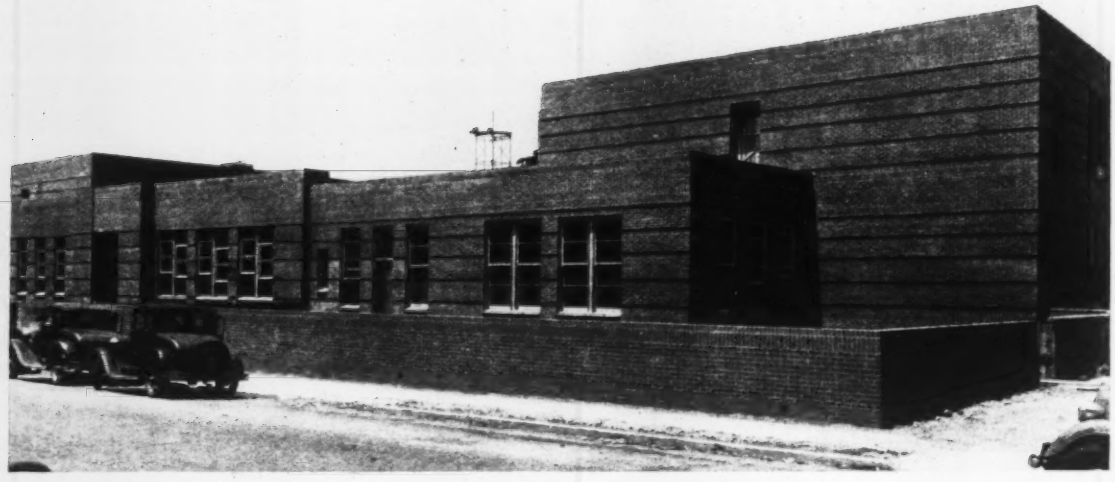


Fig. 1. Reinforced brick construction as used in a new Los Angeles school that is designed to resist earthquakes

size of the bar was made larger or the bars were grouped two in a channel.

All brick courses are stretcher courses containing no headers. Instead of connecting the withes with headers every fourth or sixth course, the grouting method used on the Vermont Ave. School provides continuous connection between every course. Also there is a mechanical grout key wherever the channels for the steel bars occur. The ratio of masonry strength to brick strength in grouted stretcher-brick masonry is about one-half, while for the ordinary header masonry the ratio ranges from one-fourth to one-third. The greater strength of the former type is attributed directly to the full connection between the withes afforded by the grout.

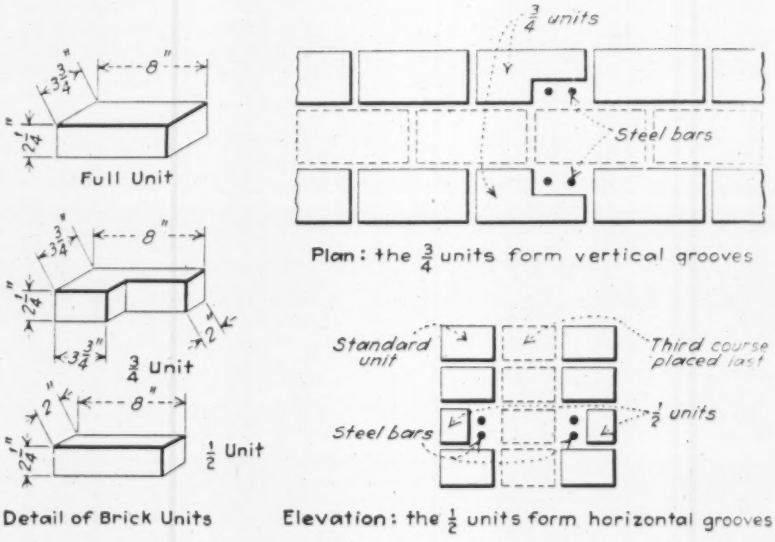


Fig. 2. Details showing three sizes of units and arrangement in a three-course wall to form vertical and horizontal grooves

Grout and reinforcing steel

The method of placing the cement grout between withes differs from ordinary bricklaying practice. Mortar of bed-joint consistency was used only for laying up the outer withes. Inner and outer withes are kept ahead of the middle course, thus producing a continuous trough into which grout was poured. Brick for the middle course then was shoved down into this grout and slightly vibrated, pushing the thin grout up on all sides and solidly filling crevices. The requirement was for grout of a flowing consistency that would penetrate all crevices and be drawn by gravity against vertical brick faces, assuring good bond with the individual units.

Because the grout is poured into a porous form instead of the usual water-tight form, the ordinary objection to an excess of moisture in the grout does not hold. Excess moisture is removed by absorption into the brick in a few minutes. This is an important asset because it brings about a decrease in volume while the mortar is still fresh, thus permitting free adjustment. As a result, actual shrinkage during the hardening process is greatly reduced and internal stresses are minimized.

Formwork for the concrete floors and roof was simplified by use of the outer brick course as an outer form. This outer course, built up slightly above the floor level before the concrete was poured, gave the advantage of insuring an intimate bond between concrete and outer brick course at the same time that it eliminated need for a special form.

Each tier of reinforcing steel was set completely before bricklaying was started. To facilitate bracing the steel the centering for the floors was erected in advance and was used for temporarily supporting the reinforcement. At the junction of walls and floor, steel was continued through

in both directions; wherever brick was laid on concrete, shear keys were used.

Mortar proportion and absorption

The bed-joint mortar was made up with one part of cement, 0.25 parts of lime putty and three parts of sand; all by volume measurement. The grout was made with one part cement, 0.15 parts of lime putty and three parts of sand. Slightly higher percentages of lime putty were used in some walls. The lime was added with a view to increasing workability as much as possible without greatly affecting the strength. The author believes the best combination of strength and workability is obtained where 65 to 70 per cent of the bonding material is portland cement and the remaining 35 to 25 per cent is lime putty. The lime also prevents segregation in the grout and keeps the mix in suspension longer.

The common brick used on the Vermont Ave. School job were found to have an average absorptive capacity of 10 to 16 per cent; the face brick averaged about 10 per cent. Wetting the brick the evening before they were laid had the effect of reducing the absorption rate and bringing the two kinds of brick to about the same absorption rate (about 5 to 7 per cent) at the time of laying.

The common bricks were grade *B* with an average compressive strength of about 3,000 lb. per sq. in. The face brick had an average strength of 6,000 lb. per sq.in. Ultimate compressive strengths of various prisms tested during this job are given in Table I. The prisms were built at the job in the form of piers and were $8\frac{1}{4}$x$8\frac{1}{2}$x17 in. in size. The only connection between the two withes was a 1-in. grouted joint. Curing and test procedure was similar to the requirements of the *A.S.T.M.* for concrete cylinders. The mortar and grout were mixed by volume measurement, dry mix; the items are listed in the following order: cement, lime putty, sand.

Prism tests also were made to determine a value for Poisson's ratio (the ratio between lateral and longitudinal deformations.) This was used to determine tensile stress across the section at the grouted joint which was found to closely approximate 0.25. Since stress and deformation are directly proportional, the tensile stress at the contact of brick and grout would be approximately 25 per cent of the compressive stress.

TABLE I — RELATIVE STRENGTHS OF MASONRY PRISMS

Number of prisms tested	Brick	Mortar	Grout	Age (Days)	Average Ult. Strength (Lb. sq. in.)
4	Grade B	1:$\frac{1}{4}$:4	1:$\frac{1}{4}$:4	28–40	1630
8	Grade B	1:$\frac{1}{4}$:3	1:0.15:3	27–40	2113
4	Grade A	1:1:4–$\frac{1}{4}$	1:1:4–$\frac{1}{4}$	28	2880
4	Grade A	1:$\frac{1}{4}$:3	1:0.15:3	28	3751

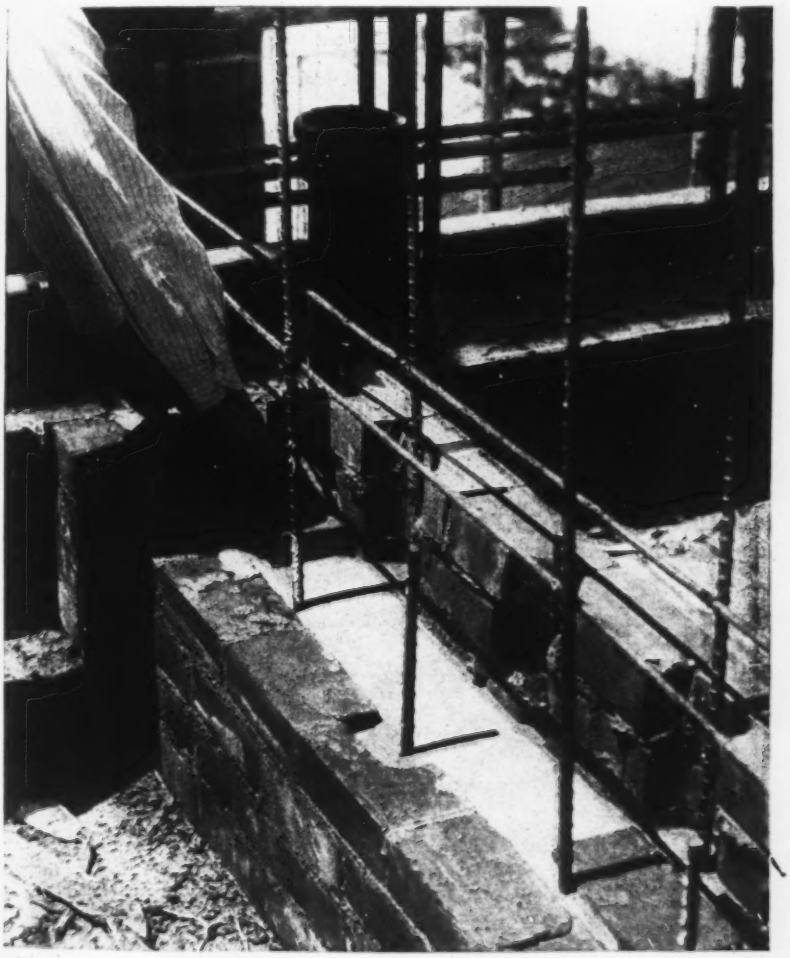


Fig. 3. Brick of the interior course is here shown being shoved down into grout previously poured between the withes

TABLE II — RESULTS OF TESTS ON CORES TAKEN FROM WALLS

Number of cores tested	Mortar	Grout	Age (Days)	Average Ult. Strength (Lb. per sq. in.)
4	1:$\frac{1}{4}$:4	1:$\frac{1}{4}$:4	31–41	1578
9	1:$\frac{1}{4}$:3	1:0.15:3	31–120	2050

Cores 8 in. in diameter drilled laterally through the walls also were taken to determine strength and character of the workmanship. The results of tests on 7 such cores are given in Table II. In all the cores and prisms tested, loading produced a cone-like failure, indicating very good bond between brick and mortar and grout.

Plans and specifications for the Vermont Ave. School were prepared by the Los Angeles Board of Education; A. S. Nibecker, Jr., school architect, James E. Byers, structural engineer. Theo. A. Beyer was general contractor on the construction of the building and Edward Ferguson was superintendent. The job was under the constant supervision of A. W. Schoolmaster of the Los Angeles Board of Education. Frequent inspections were made by the State Division of Architecture. Elmer Hagerman was resident engineer inspector for the PWA.

City Planning in Memphis

by L. P. COCKRILL

Engineer-Secretary, City and County Planning Commissions, Memphis, Tenn.

With a background of sixteen years experience in comprehensive long-term planning, a major city in the South has successfully coordinated its physical development to meet expanding needs

THE ESTABLISHMENT of a city planning commission for Memphis in 1921 resulted in the preparation and adoption of a master city plan, and set in motion forces that have since played an important part in guiding the physical, economic and social development of the city. The benefits of proper planning are indicated by the progressive growth and development of Memphis along well-ordered lines. Specific examples of major accomplishments during the past sixteen years are shown in a revision of the street layout and transit system to serve expanding traffic needs adequately, the development of parks and playgrounds properly located, the elimination of six grade crossings and the adoption of a sound zoning plan.

City planning in Memphis, as elsewhere, broadly embraces the entire life and development of the municipality, and its objectives and influence extend to every function of governmental operation and to every citizen. Among its major activities are:

(1) Street planning; the establishment of major traffic arteries and width additions thereto, the location and widening of secondary streets, and the layout of new subdivisions.

(2) Transportation and transit service and routing within and out of the city by carriers using air, water, rail or road.

(3) Public parks and recreational center development.

(4) Zoning; the segregation of residential, commercial and industrial property uses, and the preservation of adequate open spaces to insure proper light, air and ventilation.

(5) Civic art, which embraces the practical development of a city along attractive lines with special reference to the location and use of public buildings.

Benefits of planning

Long-term city planning is essential to coordinate the related activities of various governmental departments and to eliminate duplication of effort with its resultant confusion and expense. It also assists in wise spending, since the studies necessary for comprehensive planning show the trends of population and development, thereby enabling forecasts to be made regarding the need and location of future service requirements. The increased values following wise public improvements invariably result in increased revenues to the municipality.

Individual citizens receive numerous benefits as a result of comprehensive planning. Among other things they are assured of adequate transportation arteries and transit routes properly located to render necessary service, while zoning regulations protect health, stabilize property values, and permit greater enjoyment of, as well as safer investment in real estate.

A comprehensive city plan concerns itself with improvements, both present and future, necessary to insure a well-ordered community. Such a plan, properly prepared, is based on scientific engineering studies of existing conditions together with their causes, and from it an interpretation of future trends can be made. The plan should be prepared for a definite period of years ahead and it must be so designed that as the community grows adjustments can be made to meet changing conditions. This means that the various phases of planning must

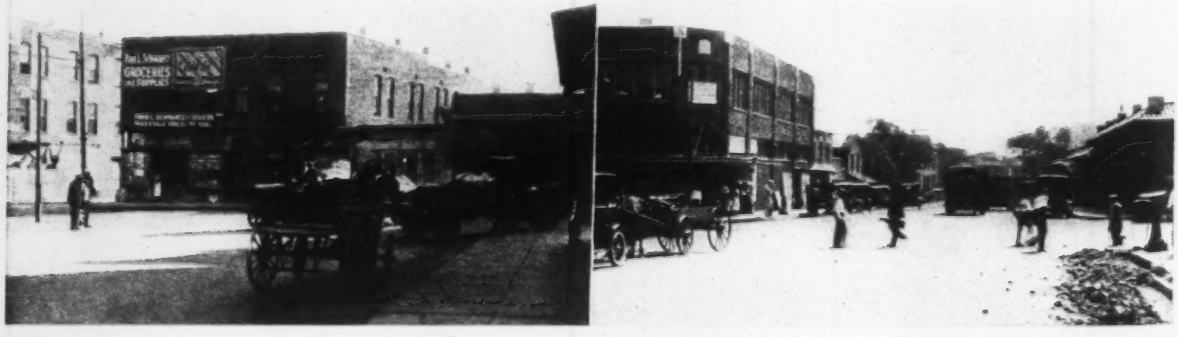


Fig. 1. Street relocation and widening has been furthered since adoption of the major street plan. Many offset streets have been aligned and dangerous intersections have been improved.

be applied to areas developed prior to the start of planning, as well as to undeveloped and unimproved areas.

The city plan of Memphis, having proven its value over a sixteen year period, is here used to indicate the nature of studies necessary in preparing a comprehensive plan. The general recommendations and some of the specific improvements, with their resultant beneficial effects, are cited to show the advantages of planning.

The plan evolved after the formation of the commission in 1921 was the result of three years of work and was prepared to cover the growth of the city for a fifty year period. When studies were initiated the city contained about 24 sq.mi. and had a population of about 162,000. Today, the city includes 50 sq.mi. with a population of over 250,000.

Major street plan

The first step in the preparation of the plan was to make an accurate map of the city. This was followed by a study of the street pattern with reference to the location, continuity and capacity of streets which would serve the needs of present traffic and in the future might be converted into major traffic arteries. This investigation revealed that: (1) A system of radial streets of varying widths extended from the central business district in a fan shape; while this system would serve as a nucleus for a major street plan, all of the streets needed additional width to serve traffic needs adequately; (2) There was no continuous through north and south street in the 2½ mile stretch from the center of the city to its western edge; (3) Practically all north and south streets offset at the east and west street through the center of the city; (4) The main street of the business district was the only thoroughfare directly connecting the central business district and the residential and industrial districts to the north with the railroad stations, freight houses, residential and industrial districts to the south; and (5) There were comparatively few sections of the city with direct street connections to other sections of the city.

The logical procedure in securing adequate through traffic arteries was to use existing streets where possible. With this in mind, the existing streets which could be used were marked out on a map and necessary interconnections were worked out. Following the selection of the streets and connections, the problem of proper widths for these streets had to be solved. This information was secured by making traffic surveys and by the use of questionnaires answered by automobile and truck owners.

Fig. 2. Grade crossing elimination has proceeded in accordance with early recommendations made by the city planning commission.

With all the information at hand the street plan was prepared. This showed the streets to be used, differentiating between those of sufficient width and those to be widened, the connections necessary and the ultimate widths required. This plan was extended beyond the developed portion of the city, and by requiring planning commission approval of all new subdivisions inside of the city or within five miles of the city limits, many of these streets, of proper width, were acquired at no cost.

Many of the improvements recommended in the major street plan have since been made. These improvements have been followed by the development of vacant land and the restoration of blighted areas with the result that property values have increased and the city has benefited by additional tax revenue.

Transit system studies

Transit system studies are an important phase of the transportation problem within the city. Interference due to vehicle traffic must be carefully considered in determining route layouts and types of equipment.

In many cities transit systems originated and expanded without benefit of proper studies. This has resulted in poorly designed systems which duplicate service and cause needless congestion. While Memphis at one time was the victim of such a condition, many of the mistakes were corrected prior to 1921 as the result of a survey and recommendations by an

engineer employed jointly by the city and the transit company. Since these recommendations were made before city planning studies had been inaugurated many necessary corrections were not included nor was a proper plan for future expansion prepared. It was necessary, therefore, to make a complete study of the entire system and suggest future changes and improvements which would properly fit the system into the comprehensive city plan.

While this study was greatly simplified by having a major street plan, it was necessary, however, to prepare a map showing present routings with reference to distribution of population. By comparing this with the street plan and other studies in connection therewith, the relations to vehicle traffic were determined.

Improving transit facilities

An analysis of the information revealed these facts: (1) There was an unnecessarily large number of left-hand turns in the central business district because of street-car loop lines; this was a principal cause of congestion and traffic delay; (2) while practically the entire developed area of the city was being served, the existing crosstown line connected only a few of the other lines, thus making it necessary for a majority of the passengers to ride into the business district, transfer and ride out again; and (3) there were several lines on important traffic arteries which duplicated service of lines only a block or two away and which were causing traffic congestion.

The problem of correcting these faults was reasonably simple and not very expensive. A study of the areas served by loop lines, the length of such lines and the headway maintained thereon indicated that a number of these lines could be consolidated and routed straight through the business district, thereby reducing both congestion and operating costs and providing better service. The remaining loop lines were rerouted through the business district. Further improvement was made by removing lines from traffic arteries where duplicate service was provided, and by replacing rail lines with either buses or trackless trolleys on other traffic arteries. The crosstown line was extended as recommended and now makes connections with other lines.

A plan for future extensions was prepared by using other planning studies to determine the growth and development of areas not then requiring service. A number of these extensions have now been carried out as recommended.

Transportation problems

Transportation problems of a city, involving the intrastate and interstate movement of passengers and freight, vary in accordance with the size of the city and the number and types of transportation systems involved. A thorough study requires consideration of four types of traffic, namely, (1) passenger traffic, (2) through carload business, (3) local carload and truckload movements, and (4) local less-than-carload business.

The location of Memphis on the Mississippi River together with the fact that the city is served by nine trunk and one local belt-line railroad, eight federal highways, and is at the junction of transcontinental airlines, necessitated numerous studies to obtain the complete picture and to determine proper recommendations for future changes and improvements.

An analysis of the facilities and operating methods of each carrier together with the type, origin and destination of freight handled by each, revealed the changes necessary to improve existing conditions. This also assisted in determining the areas that should be zoned for future industrial expansion, as well as indicating the type of industry that could profitably locate in the city. The points of interchange between carriers, the joint use of certain tracks, the abandonment of one freight house and railroad yard, the location of future additional yards, and improvements to the wharves and riverfront were among the specific recommendations. A number of the changes recommended have already been made by the carriers.

A sound program of grade crossing elimination was developed by comparing the information obtained in the transportation studies with the major street plan. Six of these grade crossings have been eliminated and construction work is under way on two others at present.

The growth of the motor vehicle carrier in recent years necessitated a separate study of this type of transportation. Approval of the city planning commission, together with approval of city officials as to routes and terminals, must be secured before these systems are permitted to operate in the city. This procedure has aided materially in minimizing congestion caused by these operations.

The airport is owned by the city and while it is located outside of the city limits, due to the absence of a desirable location inside of the city, a direct route to the business district has been provided.

Recreational facilities

It is a well established fact that pleasure and amusement are essential to a normal healthy life. In order to supply these essentials in the average city it is necessary to provide certain public recreation facilities. The types of such facilities to be provided, depending upon the size of the city and the density of population, are: (1) community centers, (2) children's playgrounds, (3) neighborhood parks, (4) recreation fields, (5) large parks, and (6) parkways and outlying parks or reservations.

The need of parks was recognized by Memphis in 1900 (then with only about 20 acres devoted to park purposes) and fortunately a foresighted park board was organized. This board employed a landscape architect to design a park plan to meet the city's needs. The result of this plan was the almost immediate acquisition of 915 acres for parks and parkways. With but few additions, this constituted the park and parkway system for the city at the start of planning.

A study of this system, together with the distribution of population with special reference to school children and juvenile delinquency, revealed the need of additional community centers, playgrounds and neighborhood parks, the need of developing certain of the property in the park system as play fields and the need of extending the parkway. A plan was prepared and this has been followed since its preparation.

Numerous improvements have been made to date under this phase of planning. The major items include locations of an additional large park, an additional neighborhood park, three tracts which have been developed as playfields, two parkway extensions and the first link of a new

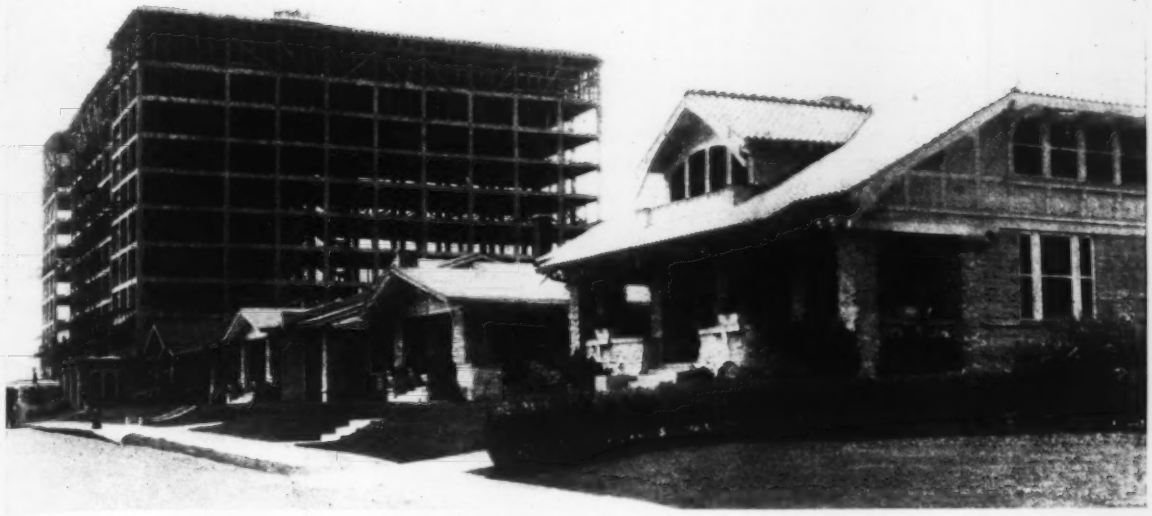


Fig. 3. Zoning regulations had not been adopted when the permit was issued for the construction of this 10-story hotel in the midst of a first-class residential section of the city.

outer parkway. In addition to these, community centers have been erected in most sections of the city, numerous playgrounds with supervised play have been provided and a large forest park and game preserve is being developed in the county. Most of these improvements have been made at small cost to the city, due in some measure to integrated planning.

Zoning is appreciated

Zoning is perhaps the most widely known and appreciated phase of city planning, due to the fact that the average citizen will come in contact with the zoning regulations more frequently than with planning activities. While city planning in its entirety is concerned with the health, convenience and general welfare of the citizens of the community, these objectives are realized more readily in connection with zoning than in other phases of planning.

A proper zoning plan is based on an intimate study of existing uses of property, building heights, lot and yard sizes, prevailing winds, areas served by paved streets, sewer, water and transit lines and the effects of other phases of planning on the future use and development of property. Future development trends must be thoroughly analyzed to insure the most advantageous use of property as the city grows.

Following the studies, the city should be divided into districts according to the logical uses of property, the heights to which buildings should be limited and the size of open spaces to be provided. Regulations for the various districts are prepared to insure the proper use of premises and the preservation of sufficient open spaces to provide light, air and ventilation for the occupants of buildings. These regulations encourage property ownership as they tend to stabilize property values by protecting residential districts from the invasion of commerce and industry until such time as the district has outlived its usefulness for residential purposes and has attained at least as good, if not a better, value for commercial or industrial purposes.

Regulations vary according to the use permitted in the district, being more restrictive for residential and public or semi-public uses than for commercial and industrial uses. In this particular, zoning and housing are closely allied and the provisions of a housing code should correspond to similar requirements of zoning in order to insure the success of both.

Since the adoption of zoning regulations in Memphis, large residential areas have been developed and home ownership has greatly increased. The pleasing appearance of these areas far surpasses that of most sections of the city developed prior to zoning, and it is the writer's opinion that the great majority of the citizens of this city would vigorously oppose any effort to nullify these regulations.

City planning should not be (though it frequently has been) confused with the municipal activity concerned with merely improving the appearance of a city. Naturally, as a city develops in conformity with a well-made plan, its general appearance is improved, but the basic principles of a city plan are founded on economic and social considerations. The beautification of a city is most certainly to be desired, but in the main this work should be left to a "city beautiful commission." Certain parts of the work however should be provided for in a comprehensive plan.

Location must be considered

Civic art, or the location and grouping of public buildings and the location of poles, wires, signs and billboards for instance, have other effects than merely creating or destroying beauty. A city with adequate and impressive public buildings is remembered far and wide for such buildings, but if these buildings are so located as to cause any appreciable degree of inconvenience to the citizens of the community who must use them the effect of their beauty is soon nullified. And if poles or signs are so located as to interfere with the flow of traffic or with light and air, their location will be criticized much more readily than if they merely present an unpleasant appearance.

It is necessary, therefore, in preparing a comprehensive plan to study

the needs to be served by the various public buildings, and to recommend their future location and grouping to meet these needs conveniently. Since the majority of the public buildings in Memphis were erected prior to the start of planning and have proven adequate thus far, progress under this phase of planning has been limited to locating a stadium and a courts building. Regulations governing the erection of billboards have been adopted.

Since planning can be carried out much more effectively and efficiently prior to development, planning activities should not stop at the city limits. Realizing this fact, the Memphis local plan was extended several years ago to cover all area within five miles of the city limits. The advantages of planning soon became apparent to other citizens of the county, and upon request work was started on a comprehensive plan for the entire county. This work has been underway for slightly over a year and has thus far resulted in the preparation of the first accurate map of the county.

While tentative zoning is in effect in the entire county, the road and zoning studies are now being made and it will be several months before they are completed. Other studies will then be made and in the near future a comprehensive plan for the future development of, and the conservation of natural resources in the county will be prepared and adopted. Such a plan will benefit the city and the county.

Rubbish Handling Cost Reduced

Tractor wagon combination system at New York City's 330-acre dump expected to yield $150,000 annual saving

MODERNIZATION of rubbish handling facilities at the huge Rikers Island dump in the East River, where diesel tractors and 40-yd. hydraulically operated transport wagons have supplanted a narrow-gage railway system, will save New York City an estimated $150,000 annually.

Rikers Island has served as a dumping ground since 1895. At that time it covered 60 acres but it has been gradually built up until it now occupies an area of about 330 acres. Between 15,000 to 25,000 cu. yd. of material, including ashes, building material debris, bottles and boxes, are delivered to the island daily. No garbage is permitted to be mixed with this fill.

The rubbish is towed out in barges to the island where it is unloaded directly into transporting units by means of stiffleg derricks equipped with orangepeel buckets. Until recently, the New York City Department of Sanitation employed a narrow-gage railway for this work, a steam engine pulling a train of dump cars to the fill. With this method, however, as the fill progressed, or the dumping point was changed, it was necessary to relay the tracks at considerable expense. Moreover, this equipment had no effect in compacting the fill, and as a consequence a considerable volume of space was wasted.

Advantages of new equipment

To avoid these inconveniences and to modernize handling facilities, the Department of Sanitation recently purchased nine 95-hp. diesel tractors and put them on the job hauling specially constructed track-type wagons. Although in operation for less than a year, the new equipment has materially reduced costs as well generally simplified and speeded up the work. In addition, the tractors and bulldozers, used as a compacting unit, have permitted the disposal of 25 to 50 per cent more refuse in the same area.

Each hauling unit consists of one diesel tractor and two 40-yd. hydraulically operated wagons. The average haul is about 1,500 ft. although occasionally it is necessary to move

Rubbish handling on Rikers Island dump, New York City, has been modernized by diesel tractors and 40-cu.yd. dump wagons

the material as much as 3,000 ft. The loaded wagons are run as close to the edge as possible, depending upon the height of the fill, which governs the hazard and the distance from which they may dump material down the slope.

All the tractors on the job are equipped with hydraulic pumps that are interchangeable for bulldozer or wagon operation. Any machine may be switched from one job to another with a minimum of wasted time. Many of the tractors are operated 24 hours a day.

Joseph C. Zengerle is engineer in charge of refuse disposal for the Department of Sanitation.

FROM FIELD AND OFFICE

Working problems and time-saving methods . . . Edited by Charles S. Hill

Liquid Mud Lifts Ship

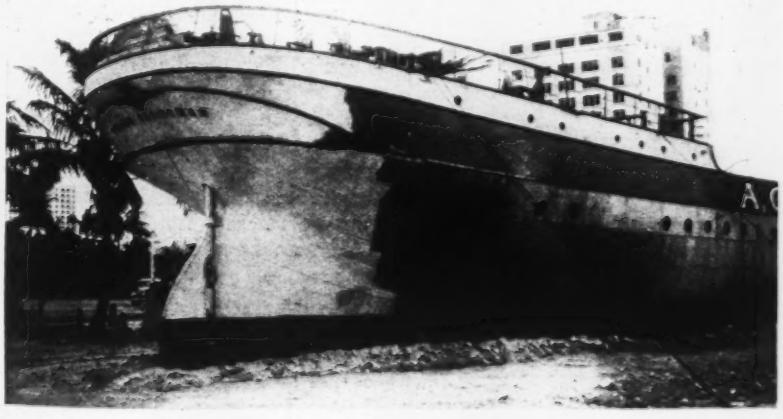
by HAROLD CHAMBERLIN

San Diego, Calif.

Liquid mud substituted for water in a cofferdam was used to raise a 2,000-ton ship 9 ft. above water in Miami harbor, Florida. The illustration shows the ship raised, filled around with sand and equipped as an aquarium. Lying along shore, the ship was enclosed in a cofferdam, utilizing the shore as one side.

The normal draft of the ship was 15 ft. and it was decided to raise her an additional 3 ft. by reducing her draft to 12 ft. Since the vessel was without machinery or cargo and could be lightened only to an inconsequential extent Tom Newman, the contractor, determined to float her in fluid of greater specific gravity than sea water. This was accomplished by using fine liquid mud which weighed 165 lb. per cu. ft. compared with the weight of salt water, which is about 65 lb. per cu. ft.

Every day, as the water inside the cofferdam was displaced by mud, the ship rose. Cables run from her mast held her on even keel, but she floated trim just as if she were in her natural element. At night, when the agitated mud settled, the ship would drop back part of the distance gained, but when the mixture was stirred up with water jets the following day and more mud was pumped in the vessel would rise again. Finally sand and gravel were forced under her keel and she was held at the desired height. Not a plate in her hull had been strained or cracked.



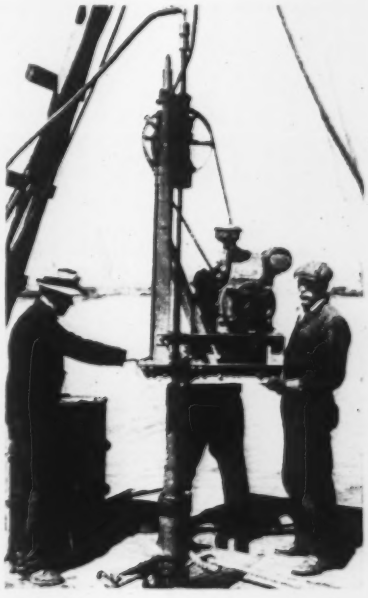
Prins Valdemar **after the work of raising her in mud was completed with the old water line now 3 ft. above ground level**

* * *

Submarine Core Drill Rig

Having 24 holes to drill to a depth of 70 to 80 ft. in 40 to 50 ft. of water, at the site of the proposed tunnel from the Battery in Manhattan under Governor's Island to Hamilton Ave., Brooklyn, in New York Harbor, the contractor devised a light rig which could be bolted to a pipe flange at the top of the 2½-in. casing. It consisted of an air-cooled single-cylinder gasoline engine of 1 hp. fitted with a 1-gal. gasoline tank, mounted on a frame, and belt-connected to the drive mechanism of the drill, which it ran, when operating at full speed, at 800 r.p.m.

The 2½-in. extra-heavy pipe casing was first driven to rock by the drill boat, and the rig was mounted on a regular pipe flange screwed to the top section. The drill has a screw feed, and the rate of feed depends on the speed at which the drill is run. There was some apprehension at first that the drill, in striking hard rock and cutting at a



Core drill rig mounted directly on the casing eliminated delay due to tide and swell.

reduced rate, would continue to run and feed at high speed, the effect of which would be, to "pull" the 2½-in. casing to which the motor was rigidly attached. Any pull on the casing was overcome by the 105-lb. weight of the motor, plus the frame, casing and what friction the casing might have in the mud.

In schist the drill cut as much as 10 ft. an hour, and where harder Fordham gneiss was encountered, the motor slowed up, so that the feed was also slowed, and about 5 ft. of progress per hour was made.

When the surface of the rock was practically bare, an extra 6-in. cas-

ing was lowered over the 2½-in. casing, and steadied by lines to the drill boat. An ordinary drill boat was used, fitted with platforms extending out from the deck on each side of the casing for use by the crew in changing drill rods.

The holes averaged about 20 ft. deep in rock, and in some cases a core the full length of the hole was recovered; the average was about 80 per cent. In several cases a core having a seam down the length of it was recovered; this unusual recovery is attributed to the speed at which the drill was rotated, and to the total absence of the usual working up and down of the drill in the hole due to wave motion.

The work was carried out by the Standard Drilling Co. under the direction of Ennis Geraghty.

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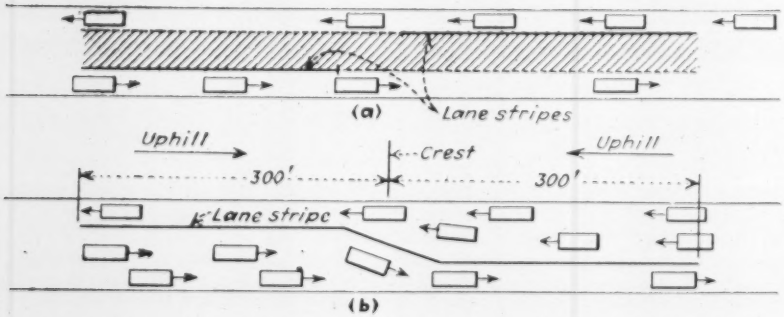
Opening Hill-Top Bottlenecks

by JAMES H. HAYES

Research Fellow, Bureau for Street Traffic Research, Harvard University, Cambridge, Mass.

Maryland has reversed the procedure followed in other states of having single-line traffic flowing up hill and double-line down-hill (sketch *a*), and has established on Route 1 double-line traffic flowing up-hill, with single-line traffic proceeding down-hill (sketch *b*). Sketch *a* shows the situation as it generally exists with the shaded portion of highway not available for traffic, giving practically the same situation as a three-lane road converging into a two-lane road over the crest of a hill. Sketch *b* shows two lanes ascending both sides of the hill converging into one lane at the crest, thus using all of the available capacity of the highway and eliminating to a great extent the long files of single-lane traffic.

A short half-hour count conducted on Route 1, Maryland, compared to the same type of count conducted on Massachusetts Route 1 North (Newburyport Turnpike), the volumes of traffic being practically the same, showed conclusively that the Maryland experiment is practicable in eliminating vertical bottle-necks. The Maryland count was conducted on Saturday, Jan. 2, 1937, from 12:30 p.m. to 1:00 p.m. A total-volume count showed 142 cars proceeding north, four of which temporarily held up four other cars at the crest where the single line was formed. The Massachusetts count was conducted on Saturday, Feb. 13, 1937, between 12:30 p.m. and 1:00 p.m. A total of 112 cars was noted proceeding north, 12 of which perceptibly held up 31 other vehicles forming a single file 300 ft. from the crest. The 100 per cent observance to the foot-wide painted line in the Maryland count left nothing to be desired, while in the Massachusetts count the figures showed that 42 or 37 per cent of the 112 cars disobeyed the rule relating to crossing the 6-in. painted line. Care was taken to select crests of hills that corresponded, so that the figures would be of value.



Customary Traffic lane marking (a) on hills limits vehicle movement as compared with marking (b) on Maryland road.

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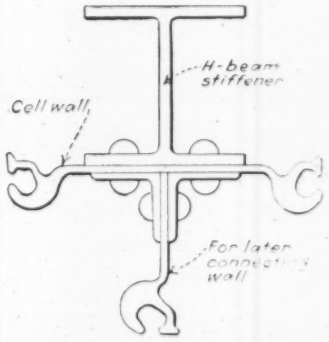
Stiffeners at Sheet-Pile Wyes

The circular cell, popular in cofferdam design, frequently requires a connecting wall of the same type, and to facilitate such a connection a wye is put in. At Grand Coulee dam an unforeseen difficulty arose as a result of the necessity of filling the circular cells some time before the connecting walls were driven. The weight of the fill causd the cell walls to bulge above the original ground line and they assumed a barrel shape which became more marked whenever leakage into the cell added a water load. The curve made it practically impossible to thread and drive the proposed connecting line of sheetpiling. The suggestion was made that such difficulties could be prevented by a special wye connection including a heavy H-beam incorporated in the cell wall where the connection was made. It was believed that a stiff member thus put into the original structure, as indicated in the accompanying sketch, will prevent curvature.



Stiffness for wye connection in cofferdam cell wall.

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Brief Memoranda

Maintenance of a constant desired chlorine residual is now in effect in five of the six Los Angeles chlorination plants, and that city now claims first honors in obtaining complete automatic residual control. The trick is done by a photoelectric cell matching a color standard with a water sample to which orthotolidin has been added. The cell operates a special valve, designed and built in the bureau shops, which increases or decreases the differential on the master vacuum chlorinators. Prior to the installation, the average dose to the 200 m.g.d. treated was 3.6 lb. per m.g. to maintain a residual of 0.1 p.p.m. Now it is 3.1 lb. and the control takes care of sudden demands due to flashy runoff or winds stirring up sediment in the reservoirs.—RAY F. GOUDEY, *Sanitary Engineer, Bureau of Water Works and Supply, Los Angeles.*

Civil Engineers Hold Summer Meeting

Transportation trends and superhighways form the principal subjects of discussion at annual convention of the American Society of Civil Engineers

HIGHWAY traffic trends and the superhighway as a means for handling increasing traffic were the principal subjects discussed at the 67th annual convention of the American Society of Civil Engineers held in Detroit, July 21-24. Other matters considered were transportation on the Great Lakes, the proposed compensatory work in the St. Clair River, subsurface utility planning, tourist camps and roadside sanitation, and the proposed bridge across Mackinac Straits.

A brief report of the business and professional matters considered at the convention was published in our issue of July 29, p. 166.

A large part of two sessions on Wednesday was given over to a symposium on the trends of modern transportation which was opened by Charles F. Kettering, president, General Motors Research Corp. Mr. Kettering's prepared paper was an analysis of replies to a questionnaire submitted to 30 men in responsible positions in the automobile and allied industries asking for their opinion on certain factors which might affect road requirements for the next 10 to 25 years. On the question of population trends, it is the consensus of opinion of a large majority of those replying to the questionnaire that the trend will be away from congested areas, thus tending toward a reduction in present traffic concentrations, but that by 1960 the highway engineer will have to provide for 50 per cent more motor vehicles. Several of those replying believe that we have reached the practical maximum speed and that engineering emphasis will be placed on other factors in the future. People on the average do not want to go over 60 miles per hour but want to go that fast without effort. All were in agreement that it ought to be possible to maintain a high average speed between cities; which indicates the need for high-speed highways built to carry traffic safely, elimination of grade crossings, limited access, separate local lanes, and by-passes around congested areas.

Adequate study needed

Murray D. Van Wagoner, commissioner, Michigan state highway department, in a paper on highway traffic and motor vehicle taxation, made a special plea for an adequate study of highway traffic requirements as the basis for all highway planning. If an efficient highway system is to be developed, said Mr. Van Wagoner, it must be built with due consideration to (1) the origin and destination of various kinds of traffic; (2) volume in which it uses streets and highways; (3) speed at which its various elements travel under various conditions; and (4) the planning of new routes to aid in the development of the state's natural resources. It also is essential that information concerning urban and rural areas be gathered separately. Traffic should be classified as to commercial or passenger, and passenger traffic should be further classified as to the social or recreational end which is served. Mr. Van Wagoner quoted Thomas H. MacDonald stating that from 70 to 75 per cent of highway traffic is generated by social and recreational motives.

After outlining the information needed and reviewing some of the obvious inadequacies of our present highway system, Mr. Van Wagoner took up the subject of motor-vehicle revenues and reviewed the history of motor-vehicle taxes in Michigan. On the use of motor-vehicle revenues he said, in part: "Safe, efficient and well sustained highway service as well as common fairness to automobile owners demands that until the major roads are adequately improved, the bulk of the motor-vehicle revenues must be devoted to those highways which carry the bulk of the traffic contributed by rural and urban residents alike. This will necessarily exclude a considerable mileage of urban streets and rural roads from improvement at the expense of motor-vehicle revenues. If any motor-vehicle revenues are allotted to those local roads and streets, it should not be greatly in excess of the amount they generate. Some form of general tax should pay the bill for any further needed improvements on them. Improvement of urban streets by motor-vehicle funds should not take place until trunk-line arteries or relief streets thereto in or near cities are completed."

Distribution of revenue

Motor vehicle users should pay a large part of highway service cost, said Roy W. Crum, director, Highway Research Board, in discussion of Mr. Van Wagoner's paper, but to require them to pay all the cost is unsound. The community as a whole must have access to the land and homes and should be required to pay part of the cost. How the cost should be distributed is a debatable question. On trunk highways the user is the principal beneficiary but on local roads the adjacent land and communities are large beneficiaries. Probably the road survey now being carried out by the states under the U. S. Bureau of Public Roads will provide data on which to base a fair distribution of the cost. As to distribution of the gas tax, Mr. Crum said that the traffic survey and statistics of fuel consumption should

aid in its allocation. License fees can well be allocated to the state road system on the basis that it is a ready-to-serve charge.

Highway trends

Thomas H. MacDonald, chief, U. S. Bureau of Public Roads, in a paper presented by C. D. Curtiss of his staff, pointed out that the large diversion of highway funds to other purposes and the spread of revenues over a wide variety of roads has resulted in placing a very difficult problem in the hands of highway builders. He believes that the survey now in progress will serve to improve future highway planning materially.

As to highway trends, Mr. MacDonald said that the present trend is definitely toward a classification of highways on the basis of use. Elimination of railroad grade crossings on all major highways is now accepted as an objective, and following that will come the elimination of crossings with other highways. Highway arteries to the centers of large cities will come in the near future. There is a need for a considerable mileage of superhighways but they must be based on the findings of the nation-wide survey now in progress and should be built only where traffic warrants them on an income basis. They should not be laid out as a transcontinental system.

Fred Lavis, consulting engineer, New York, former engineer of the New Jersey state highway department, said that he found Mr. MacDonald's paper in pleasing contrast to many recent discussions of our highway problem because Mr. MacDonald faces realities. As evidence of the unrealistic view, Mr. Lavis quoted Miller McClintock as stating that the American highway system must be scrapped.

On the subject of highway planning, Mr. Lavis said that we must recognize the commercial aspects of highway requirements and that highway funds must be spent on facilities to serve the greatest need rather than on imposing schemes that serve relatively few. Designing highways for speeds of over 50 or 60 miles an hour is not justified, he said; designing for speeds of 100 miles per hour ignores the human element. Further, as maximum traffic capacity is attained at speeds of about 35 miles per hour, and as present needs are for the greatest possible capacity, any expenditure in excess of that required for speeds of around 50 or 60 miles an hour is not justified.

Burton W. Marsh, director, Safety and Traffic Engineering Department, American Automobile Association, stated that it is encouraging to find that highway engineers now are giving such wide attention to use problems and to the location and elimination of existing hazards.

Trunk highways

Trunk-line highways in metropolitan areas and the place of the express highway in the modern road system were made the subject of further discussion at the highway division meeting on Thursday. LeRoy C. Smith, chief engineer, Wayne County Road Commission, stated that change in route use is one of the important factors to be considered in trunk highway design. If the hub of today is not adequately served by arterial roads, he said, it will not be the hub of tomorrow and expenditures for inadequate arterial roads thereto will be largely wasted. Mr. Smith laid especial emphasis on the need for adequate right-of-way for major highways. Details of the highway design may change in the future but if the right-of-way is adequate they will present no problem. In Detroit the minimum width of 100 ft. is specified for major highways, 86 ft. for secondary, 204 ft. for superhighways, and 150 ft. for parkways.

Mr. Smith outlined the master highway plan of Detroit and stated that the chief reason for Detroit's success in getting so much accomplished is that the law giving effect to the plan contains adequate condemnation provisions. Since the master plan was adopted a supplementary plan has been added which provides for cutting 204 ft. streets through blighted areas to supplement the original superhighway system. This is expected to increase property values and to relieve the load on the main system.

Robert Kingery, secretary, Chicago Regional Planning Association, in discussing Mr. Smith's paper, said that one of the chief factors in the success of the Detroit work is the continuity of personnel directing the work. Chicago's problem is complicated by the extensive built-up area surrounding the Loop district. About all that has been accomplished within the city proper is the work along the 14 miles of waterfront. Plans for a major trunk highway to the west call for razing solid blocks of buildings to make a wide highway on which pavement can be laid out to best suit local needs. Mr. Kingery is in favor of cutting wide highways through blighted areas and stated that the resulting improvement in real estate values, reduction in cost of fire and police protection, and decrease in in tax delinquencies will go a long way toward offsetting the cost.

Express highways

Speaking on the subject of the place of the express highway in a modern road system, Prof. John S. Crandell of the University of Illinois said that the superhighway is best exemplified by the superhighways at Detroit with their provisions for motor vehicles, rapid transit, pedestrians, etc. He endorsed a statement made by A. W. Dean (*ENR*, June 24, 1937, p. 946) that the usefulness of express roads will be reduced rapidly by the encroachments of gas stations, hot dog stands, etc., unless encroachments are carefully restricted by zoning or other means. Prof. Crandell said that large cities need to build express highways to keep on the map. He favors a system of express highways "across and up and down our land," and outlined the major routes to be followed by such a system.

Robert B. Brooks, consulting engineer, St. Louis, took the opposite view to that expressed by Professor Crandell in regard to a network of highways connecting all our major centers of population. Our major express highway system, he said, should be built only to meet our current needs, not laid out like the German system. He sees no economic justification for a network as proposed by Prof. Crandell.

In further discussion it was brought out by S. Johannesson, Trenton, that express highway planning must take into consideration the fact that the express highway not only serves existing traffic but causes the development of other traffic. Prof. John S. Worley, Ann Arbor, stated that

the first essential to the construction of express highways is a complete study to determine where the greatest need lies. He questioned the monetary values placed on many of the supposed savings that are used to justify construction of express roads, bridges, etc. As an example, he cited the practice of putting a monetary value on the time saved by all passengers in motor vehicles, including babies. Prof. R. L. Morrison, Ann Arbor, urged conservatism in planning express highways and pointed out that if Michigan spent as much as 10 per cent of its highway income on such roads it would only build about four miles each year.

Subsurface utilities

The city planning division devoted its time to consideration of the work of its committee on the location of underground utilities, organized five years ago. Arthur W. Consoer, chairman of the committee, spoke on the need for subsurface planning and H. H. Kranz, another member of the committee, discussed the basic principles involved.

Mr. Consoer, on the question of needed planning, stated as follows: Engineers as a matter of routine construct pipe galleries at filtration plants and sewage treatment plants, but few have taken steps to provide tunnels in the city streets to house underground utilities in congested sub-surface situations in order to facilitate access to the utilities, to simplify enlargement of such services, to prevent unnecessary investments in cable, pipe, etc., to prevent breakage of conduit and pipe and to eliminate destruction of pavements for work in connection with underground utilities and to eliminate interruptions to traffic caused by work on underground utilities installed in the usual manner.

No sustained effort has been made to correlate the sub-surface operations of utility companies, sewer department, water department and other agencies in charge of underground utilities and to correlate such underground operations with new paving work. The need for such coordination is apparent, but due to some strange perversity or to the pressure of seemingly more important activities in city engineering offices, practically nothing has been done in United States cities and towns to bring about the organization of effective coordinating committees on the location of underground utilities.

Mr. Kranz, in his paper, stated that in street reconstruction the chief problem is the underground one; the paving presents the engineers with few problems. Cities, he added, should stop haphazard location of gas, water, sewer, electric and telephone utilities. As a first essential to this they should establish an underground agency, probably as a subdivision of an existing department, which would set up an accurate system of record keeping and adopt a policy for granting permits and assigning areas to the several utilities. This policy, he stated, must necessarily be flexible because of inevitable conflicts. Mr. Kranz recommended use of the Am. Soc. C. E. "Outline of Suggested Practice for Location of Underground Utilities."

Great Lakes transportation

The waterways division devoted itself to a consideration of the Great Lakes navigation system, the principal paper being a comprehensive historical review of the development of the Great Lakes as a navigation system prepared by Brig. Gen. Max C. Tyler. The first surveys for navigation purposes were made by the army engineers on Lake Erie in 1819, work was begun on harbor improvements at Cleveland in 1825, at Oswego in 1827, and in Chicago in 1833. The first Welland Canal was built by the Canadians in 1829, and the first locks at the Soo were built by the state of Michigan in 1855 to facilitate ore and lumber movement. Improvements have continued progressively since that time until now channels have a depth generally of 25 ft. and widths of from 600 to 800 ft. for two-way traffic.

Summing up, General Tyler said that the present results have been obtained by the application of good engineering and sound business judgment, and by planning for the future only so far as definite benefits could be foreseen.

In answer to a question as to the manner in which matters of international aspect such as aids to navigation, locks and channel construction have been arranged, General Tyler replied that improvements involving channels through Canadian waters were matters to be taken up with the Canadian government by our State Department. He further stated that whenever necessity arose for channel improvement, the location was selected on the side of the international boundary giving the best alignment and least construction expense. The new Welland Ship Canal was referred to as one of the improvements made by the Canadian government and used by all vessels whereas on the St. Mary's River downbound deep-draft vessels use the American locks because greater depths are available over the sills than over those of the Canadian locks. L. C. Sabin, vice president, Lake Carriers' Association, discussed the international aspect, attributing the cooperation of the American and Canadian governments to the lack of red tape, and the general confidence in the engineer officers in negotiations concerning both parties. Expenditures by the Canadian government for improvements on the lakes were stated to be in proportion to the amount of Canadian traffic.

Lake level improvements

Recent developments in connection with the proposed compensatory works in the St. Clair River were the subject of comment by Col. C. R. Pettis and Sherman Moore of the U. S. Lake Survey. Construction of 31 rock sills across the river bottom as a means for raising water levels in Lake Huron and Lake Michigan was recommended by the St. Lawrence Waterway Joint Board and was authorized by Congress in 1930. The sills were to be of loose rock with crests 50 ft. wide and with upstream and downstream slopes of 1 on 3.

In 1931 the Lake Survey was instructed to make a study of the proposed compensatory works and experiments were begun in a small flume at Ann Arbor. Subsequently studies were conducted at the U. S. Waterways Experiment Station at Vicksburg, first in a flume and then in a large model of the St. Clair River channel.

These tests showed that flow over such deeply submerged weirs differs from that over the usual broad-crested weir, and that backwater is primarily a function of the turbulence produced by the obstruction. They showed

further that sills with vertical upstream faces would produce the greatest turbulence and the greatest backwater.

The authors of the paper said they believed that the sills will not increase the difficulties of navigation but that their construction has presented a problem not yet satisfactorily solved, nor is it known what their maintenance cost will be.

In view of their studies, the authors question the economic value of the large expenditure involved.

No construction work has been undertaken. Money was allotted for the construction of two sills a few years ago but the Canadian government would not consent to the start of work until higher lake levels had been attained through natural causes.

In the absence of C. O. Wisler, professor of hydraulic engineering, University of Michigan, who had much to do with the experimental work referred to in the paper, Louis E. Ayres, consulting engineer, Ann Arbor, read a discussion in which it was stated that the usefulness of compensation to navigation exists only during low water years, and that there might be serious objection to it because of the effect on the lower or downstream lakes.

Regulation rather than compensation was suggested in further discussion, with a view to providing permanently higher lake levels with large discharge channels. Reference was made to the possible diversion of water from the Hudson Bay drainage area to the Great Lakes, as proposed by Canadian engineers.

Mr. Moore expressed the opinion that regulation is not possible except in considering individual lakes, and that there are two diametrically opposed interests: the navigation interests desiring uniform lake stages, and the power interests desiring uniform flow.

Tourist problems

Problems presented by tourists were the subject for discussion by the sanitary engineering division. Edward D. Rich, engineer of the Michigan Department of Health, said that in the season from July 1930 to July 1931 operators of foreign cars to the number of 2,500,000 visited Michigan and spent $274,000,000 in Michigan towns and summer resorts.

Subjects to be considered in the regulation of trailers as listed by Mr. Rich are, provision for adequate water supply and disposal of sewage and refuse, protection against the spread of fire in closely parked trailers and the regulation of unsightly construction to keep the parking areas from being a detriment to their neighborhood.

Mackinac Straits bridge

The proposed bridge across Mackinac Straits to connect the two peninsulas forming the state of Michigan was the subject for discussion at a general session held on Friday morning. The principal paper was by Prof. James H. Cissel, consulting engineer to the Mackinac Straits Bridge Authority.

Proposals to bridge Mackinac Straits have been under consideration since 1920, three years before the state inaugurated a highway ferry service. Limited studies of a bridge were made in 1928 which resulted in a preliminary estimate that a bridge from Mackinaw City to St. Ignace, a distance of about 5¼ miles, would cost $30,000,000. In 1933 the PWA was approached on the subject of granting funds and in the following year the state set up the Mackinac Straits Bridge Authority authorizing it to issue bonds secured by tolls to finance a bridge at one of the proposed locations. The bridge authority engaged Charles Evan Fowler as temporary chief engineer as he had made the initial proposal in 1920, and applied to the PWA for funds, but its application was disapproved in 1935. Subsequently Francis C. McMath was appointed chief engineer and James H. Cissel consulting engineer.

Only $13,500 has been made available for studies, hence the bridge authority has been handicapped for lack of adequate information upon which to prepare full estimate of costs. The present plans call for a bridge 5.18 miles long with a main cantilevered span of 1,700 ft. and with main piers in water of depths up to 180 ft., estimated to cost $32,400,000. The bridge is designed to carry two railroad tracks in addition to the roadway.

Traffic has increased from 75,000 vehicles in 1926 to 215,000 in 1936, over 10,000 of which were trucks. Four ferries are now in service during the summer season, but even so there are very long delays in crossing the straits and it appears evident that several million dollars will have to be spent on expanding the ferry service if a bridge is not built.

Discussion centered chiefly around the economics of the proposal, whether the bridge could be made a paying proposition with continuation of the present ferry tolls which average $1.77. Looking ahead 30 years, C. F. Goodrich, chief engineer, American Bridge Co., concluded that there was reasonable evidence that the bridge could be amortized with a toll of $1.00 per vehicle. He said further that Michigan might well finance part of the cost out of highway revenues just as it finances the cost of any other major highway link.

Analyzing the present and prospective cost of continuing the ferry service and bringing it up to meet the growing traffic needs, Carlton S. Proctor, consulting engineer, New York, concluded that the state could better afford to build a bridge than to make a major capital outlay for additional ferry service.

No insurmountable problems

No insurmountable physical problems seem to stand in the way of the construction of the bridge, but Mr. Proctor pointed out that the two main piers, which will have to be located in 180 ft. of water and will be at the edge of a deep canyon, present new problems in the pier building art. Borings show that from 30 to 40 ft. of difficult sinking materials overlie the rock at the pier sites. Although piers of the Bay Bridge were carried to depths of around 240 ft. below water level, the maximum depth of open water encountered in San Francisco Bay was 120 ft.

George T. Horton, president, Chicago Bridge & Iron Co., supplemented the information concerning the proposed bridge with a discussion of the possibility of building a submerged vehicle tunnel across the straits. Edwin F. Wendt, consulting engineer, Washington, stated that it appeared to him that the cost of the bridge project would be greater than the estimates indicated, especially as depreciation was included, but he felt confident that if all the factors involved are considered, the project will pay large dividends.

THE WEEK'S EVENTS

(Continued from page 211)

New York Housing Projects Winning Tax Exemption

Tax exemption for limited dividend housing projects appears to have been accepted by New York City, with the recent restoration of the buildings of the Amalgamated Housing Corp. and Amalgamated Dwellings, Inc. to their tax exempt status without formality of a trial.

The buildings in limited dividend housing projects under supervision of the New York State Board of Housing, were originally declared exempt from local real estate taxation when the New York state housing law was enacted in 1926. In 1927 New York City enacted a law granting such exemption for a period of 20 years. Projects enjoyed this exemption without question until 1933, when New York City amended the local law to require the approval of the board of Estimate and Apportionment before granting exemption to the projects thereafter erected. Shortly after, as part of the general move to reduce tax exemption, the board of taxes and assessments put the projects in the tax rolls, thereby forcing the housing corporations to begin court proceedings reviewing the board's action.

So far four decisions uphold the right of limited dividend housing projects to tax exemption. Although the city's appeal from the decisions will keep all the cases in the court for another year or two, the recent action of the city on the Amalgamated companies indicates an acceptance of the tax exemption status of the project.

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New Chicago Sewer Link Opened July 26

The Sanitary District of Chicago on July 26 opened its new $3,500,000 combination storm and sanitary sewer serving the western suburbs of Oak Park, Berwyn, Forest Park and Stickney. Started in April, 1936 the 5½ mile drain varies from 9 ft. 4 in. to 13 ft. 9 in. in diameter. About half its length was blasted out of rock, other portions were tunneled through clay and muck, and where soil conditions permitted open cuts as deep as 20 ft. were employed.

Near the new sewage treatment works in Stickney, a control structure shunts the storm water directly into the drainage canal without treatment. Work on the entire program is well on schedule and completion by December, 1938 is practically assured. By a U. S. Supreme Court decision, diversion of water from Lake Michigan into the Chicago River for sewage transfer must be cut to 1,500 cu.ft. per sec. by January, 1939. At present diversion is about 2,500 cu.ft. The maximum diversion before the program was started was in excess of 7,000 ft. per sec. Construction is proceeding on the lock at the mouth of the river to control the flow from Lake Michigan.

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Connecticut Building Strike Ended by Pay Rise

Work has been resumed on building projects in Waterbury and Greenwich, Conn., which had been brought to a standstill for several days by a strike of hodcarriers, laborers, masons and carpenters. The new Waterbury union of hodcarriers and laborers was given union recognition and wage increases. Laborers and hodcarriers will receive 65 cents an hour with a 40 hour week for hodcarriers and a 44 hour week for laborers with time and one-half for overtime.

In Greenwich, common laborers formerly paid $5 and $6 a day, will now receive $6.40 and $7.50 a day.

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Road Builders Begin Study Of Accident Causation

A study to determine the effect of faulty highway design in producing automobile accidents is being begun by the Problems Committee on Analysis of Accident Records, a subcommittee of the American Road Builders Association's Committee on Safe Highways.

The committee will analyze accident data on 50 pieces of highway throughout the country on which there is a large number of accidents. Data to be collected will include a collision diagram showing all the motor vehicle accidents for some given period of time, and a short summary of the accident experiences to explain the collision diagrams. A blueprint of the highway locations and a photograph, if possible, will also be made in such a way as to show all the design features.

Extra Water Demand For Air Conditioning

Commerce studies find increased demand on water system from air conditioning

The increasing use of air conditioning apparatus in the United States, with a resulting demand for increasingly large quantities of water, much of which when used once is discharged into sewer systems, is a matter of growing concern to officials of many municipal governments, according to a study made public July 24 by the Marketing Research Division of the Department of Commerce.

The report, entitled "Effect of City Water Sewerage Facilities on the Market for Air Conditioning Equipment," states that installations of air conditioning units have increased about 1,400 per cent from 1933 to the end of 1936 and that horsepower used has increased from 168,880 at the end of 1932 to 432,796 at the end of 1936. Thirty-eight of the 92 cities reported upon in this study informed the department that steps had already been taken or were being considered to limit the use of water-using air conditioning equipment.

Because of the limited sewerage capacity in the loop district of Chicago, the installation of water-using air conditioning plants which are not equipped with a cooling tower or otherwise equipped to avoid the necessity of discharging water into the sewer system is being discouraged, it is stated. Certain cities, including Atlanta, Chattanooga, Columbus, Ohio, Dallas, St. Paul, Scranton and South Bend are now using the full capacty of their water system and are not in a position to furnish additional water until the system has been enlarged. Many other cities throughout the United States are now using from 75 per cent to 90 per cent of their available water capacity and could not readily furnish additional large quantities of water, it was pointed out.

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Highway Officials Meet in Portland

Representatives of highway departments of eleven western states will meet in Portland, Ore., Aug. 16, to consider standardization of Pacific highway codes. The meeting was called by Ray Ingles, director of the California department of motor vehicles, to draft an interstate contract providing for reciprocity in treatment of commercial and private vehicles on highways.

Two Generators Added At Boulder Dam

Two large generating units which will bring the installed generating capacity at Boulder Dam to half of its full value of 1,835,000 hp. were provided for on July 22 when Secretary of the Interior Ickes awarded contracts totaling $1,985,000 for electrical equipment. When these units are operating, and half of Boulder Dam's capacity is installed, the dam will have a larger output than any existing hydroelectric plant in the world.

The chief items contracted for were two vertical-shaft 115,000-hp. hydraulic turbines and governors to be obtained from Allis-Chalmers Mfg. Co. on its bid of $1,080,000. Contracts for auxiliary equipment were awarded to the General Electric Co. and the Pacific Electric Mfg. Corp.

Four generating units, similar to those now to be installed, are already operating on a firm power basis, serving the city of Los Angeles and other municipalities in Southern California. Two additional units are now in process of manufacture. When completed in 1938, these will serve the metropolitan water district of Southern California. The units just contracted for will be ready for operation in 1939 and 1940.

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Ontario to Dig Channel

A channel from the southern end of Longlac in northern Ontario to Lake Superior to provide for the passage of 250,000 cords of pulpwood annually has been planned by the Ontario Hydro-electric Power Commission. The Ontario government is contributing $100,000 to the total cost, $687,000. The waterway is to be complete by June 1, 1938. Diversion of this water will add 1,250 c.f.s. to the flow of the St. Lawrence watershed.

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Patrick Will Head Surveys For Soil Conservation

A. L. Patrick has been appointed to direct survey activities of the Soil Conservation Service. As chief of the survey division, Dr. Patrick will direct the work of the Soil Conservation Service in connection with flood control planning under the provisions of the Omnibus Flood Control Act of 1936 as well as the regular erosion and land use surveys required as the basis for soil conservation operations of the Service. Preliminary examinations on 222 watersheds listed in the flood control act are being carried on in cooperation with the War Department to determine the feasibility of making detailed surveys later as the basis for erosion and flood control operations.

For the past three years Dr. Patrick has been on leave of absence from Pennsylvania State College while serving as a technical and administrative official of the Service. He resigned his faculty post to accept the appointment with the Soil Conservation Service.

Dr. Patrick graduated from Pennsylvana State College in 1913 and served for six years in the Bureau of Soils of the Department of Agriculture. He then served as professor of soils at Pennsylvania until he was granted his leave of absence in 1934, to act as regional director for the Soil Conservation Service in Pennsylvania.

CALENDAR OF MEETINGS

NATIONAL SOCIETIES

CANADIAN GOOD ROADS ASSOCIATION, annual convention, St. Andrews-by-the-Sea, N. B., Sept. 7-9.

AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS, annual convention, Boston, Sept. 27-30.

AMERICAN PUBLIC WORKS ASSOCIATION, annual conference, Atlanta, October 4-6.

AMERICAN PUBLIC HEALTH ASSOCIATION, annual meeting, New York, Oct. 5-8.

NATIONAL COUNCIL OF STATE BOARDS OF ENGINEERING EXAMINERS, annual meeting, Scranton, Pa., Oct. 11-13.

NATIONAL SAFETY CONGRESS, Kansas City, Oct. 11-15.

REGIONAL AND LOCAL

SECTION MEETINGS, AMERICAN WATER WORKS ASSOCIATION, Central States, Dearborn, Mich., August 18-20; North Carolina, Wilmington, N. C., August 26-28; Rocky Mountain, Santa Fe, N. M., September 20-22.

NORTH CAROLINA SOCIETY OF ENGINEERS, annual convention, Wrightsville Beach, N.C., Aug. 13-14.

MONTANA BITUMINOUS CONFERENCE, annual conference, Glacier National Park, Sept. 7-9.

NEW ENGLAND WATER WORKS ASSOCIATION, annual convention, Poland Spring, Me., September 21-24.

ROCKY MOUNTAIN SEWAGE WORKS ASSOCIATION, first annual meeting, Santa Fe, N. M., Sept 20-23.

Wall Strengthening Urged For Needham School

Recommendations have been made for repairs to the Needham, Mass., junior high school which it is believed will permit its safe reopening. The school was shut last June when cracks observed in the wall led to the fear that the building was in an unsafe condition.

The school, erected about 14 years ago, was built with exterior walls of brick and hollow tile, the brick being 4 in. thick and the tile 12 in. thick to the roof. The three story building has overall ground dimensions of 215 ft. by 65.5 ft., and the walls rise about 45 ft. above the foundation. A central interior corridor with hollow tile walls and reinforced concrete flooring separates the classrooms. The main flooring of the building is of timber construction.

After the development of an interior wall crack and indications of a certain amount of wall deflection, the school was closed as a precautionary measure. Investigation showed that the south end wall was out of line by 1½ in., the southeast corner being out 1⅝ in. and the southwest corner 1 7/16 in. The northeast wall was out ⅝ in. at the center top and the east corner was out ¾ in. The corridor walls in the attic space were found to be parted from the end walls by about the amount of deflection in the end walls. Joints in the parapet walls had opened, and masonry had been exposed to water.

It has been recommended that necessary pointing be done in various places, together with flashing, and that the end walls be strengthened by running flat steel bars about 25 ft. long as ties between the end walls and the corridor walls, placing two bars in each end of the building on each floor. It is believed that this anchorage will provide the increased structural strength desirable.

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Express Highway and Dike Proposed at Hartford

A dike to protect the city of Hartford, Conn., against floods in the Connecticut River, which would be topped by a four lane boulevard 7 miles long and traversing the entire length of the city from north to south, has been proposed by the city engineering department and is now being studied by the flood commission.

The plan calls for widening of a number of the principal business streets, building of ramps, and construction of a new clover-leaf approach to the East Hartford bridge.

OBITUARY

CHANDLER H. NELSON, 37, a member of the Baton Rouge contracting firm of Nelson Bros., died recently in Sanford, Fla.

EMMET H. ELDER, 43, chief civil engineer of the Pyramid Coal Co. of Pinckneyville, Ill., died in St. Louis, Mo. July 20.

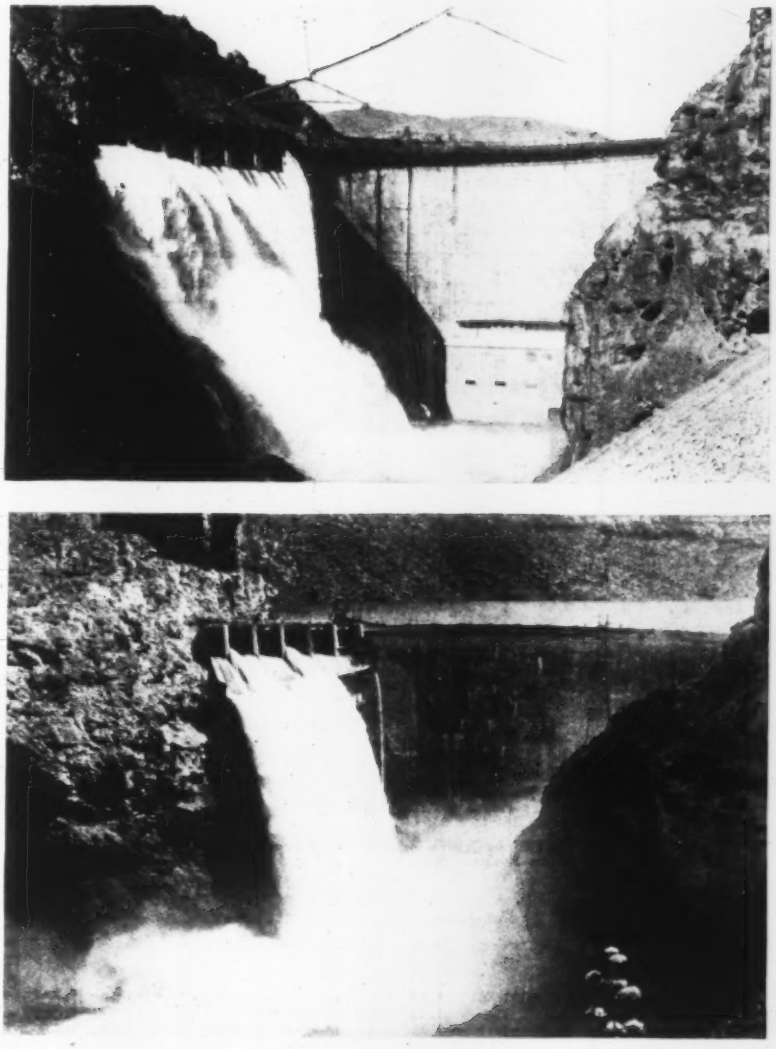
E. C. KERRIGAN, 54, a director of the Canadian company operating the Detroit-Windsor tunnel and formerly connected with the construction of the Quebec bridge, died July 19 in Windsor, Ont. Mr. Kerrigan served as chief draftsman during the construction of the Quebec bridge for the St. Lawrence Bridge Co., representing the Canadian Bridge Co. He was later associated with the Great Lakes Shipbuilding Corp. of Detroit.

FRANK D. CHASE, Chicago architectural and engineering consultant, died July 23 in Evanston, Ill. at the age of 57. A graduate in 1901 of the Massachusetts Institute of Technology, Mr. Chase early served as architect for the Chicago & Alton, the Minneapolis & St. Louis and the Iowa Central Railroads, as well as for the Western Electric Co. In the course of his consulting practice he designed numerous office buildings in the Chicago area and throughout the Middle West as well as several Chicago hospitals. He was a past president of the Western Society of Engineers.

WYATT S. HAWKINS, chief engineer of Division No. 3 of the Missouri highway department, died at Hannibal, Mo. July 15 at the age of 61. From 1889 to 1906, Mr. Hawkins was field engineer for the U. S. Dawes Commission, and after several years service with the Department of Indian Affairs, the Missouri, Kansas & Texas Ry. Co., and in private practice, he became state highway engineer of Missouri. After two years in that post he entered private practice in Oklahoma City staying there until the war. After service as captain in the 55th Engineers he began practice at Greenwood, Miss.

ROBERT S. SAUNDERS, an assistant engineer of the New York City Board of Transportation, died in that city July 26 at the age of 53. Mr. Saunders was a graduate of Cooper Union. He joined the engineering department of the New York Central Railroad in 1903 and was later connected with the Hudson & Manhattan Railroad Co. In 1912 Mr. Saunders entered the engineering department of the New York board of water supply and after several years with that agency and with the New York City Public Service Commission he became connected with the Transit Commission. In 1924 he began his employment with the Board of Transportation.

JOSEPH M. CLAPP, Seattle civil engineer, died there July 20 at the age of 71. After his graduation from Royal Military College at Kingston, Canada, and several years service for the San Gabriel Rapid Transit Railway, he entered the U. S. Engineer Department in 1889, becoming assistant engineer at Portland. Three years later he became principal assistant engineer of the Seattle district, holding that position for fifteen years until he entered private practice. Mr. Clapp was connected with the construction of the Grays Harbor and Puget Sound Ry., was a former chief engineer of Waterway District No. 1 of Kings County, Wash., and was instrumental in the construction of the Lake Washington ship canal at Seattle and the Lake Youngs reservoir of the Seattle water system.



SPILLWAY CHANGES MADE AT HORSE MESA DAM

MAJOR CHANGES are being made in the spillway of Horse Mesa Dam on the Salt River in Arizona as a result of ten years of experience. The pictures show, at the top, the dam as it was nearing completion in 1927. Flow from the six gates, totaling 67,000 sec.-ft. at full opening, was discharged directly down the canyon wall to the river 210 ft. below. This year a lip has been added to the spillway so that the overflow is thrown clear of the canyon wall, as shown in the lower picture, in which about 5,200 sec.-ft. is being discharged. Another view is shown on p. 216. The capacity of the spillway also is being increased by a tunnel through the canyon wall to the river below.

MATERIALS AND LABOR PRICES

Market quotations on construction materials and wage rates reported monthly by ENR correspondents

PRICES AS A WHOLE show no major movements this month. Lumber prices are lower, at Boston, Kansas City, Philadelphia $2.00 and at St. Louis $1.00 for Short Leaf Yellow pine. Douglas fir is $2.00 and $3.00 lower than a month ago at Boston but $1.00 higher than last month at Kansas City.

Brick prices are up $2.50 per M at Detroit. Sand and gravel prices are up 10 cents a ton at Philadelphia and St. Louis. Ready mixed concrete is 25 cents higher at Philadelphia and 75 cents per cu. yd. higher at Detroit.

Common labor is higher at Detroit as are wage rates for structur[illegible] and hoisting engineers. Skilled labor wage rates at San Franci[illegible] are higher this month with the 6 hour day in force for bricklayers and plasterers. At Seattle the 6 hour day prevails. Montreal will see a 10 cents per hour increase going into effect for skilled trades on August 12.

CEMENT, AGGREGATES, READY-MIXED CONCRETE—F.O.B. CITY

	PORTLAND CEMENT (Per bbl., carload lots, including 40c per bbl. for bags, cash discount not included)			SAND AND GRAVEL (Per ton, carload lots)			CRUSHED STONE (Per ton, carload lots)		CRUSHED SLAG (Per ton, carload lots, f.o.b. plant)		CONCRETE (1:2:4, 5.0 gal. mix, delivered)
	Cloth Bags	Paper Bags	Bulk	Gravel, 1½ in.	Gravel, ¾ in.	Sand	1½ in.	¾ in.	1½ in.	¾ in.	
Atlanta	$2.83	$2.58	$2.50	$1.65	$1.65	$1.55	$1.65	$1.75	$1.65	$1.75	[illegible]
Baltimore	2.31	2.06	1.86	1.80‡	1.80‡	1.30‡	1.80‡	1.80‡	1.80	1.80	[illegible]
Birmingham	2.40	2.15	1.95	1.80	1.80	1.45	1.00	1.00	.90	1.15	[illegible]
Boston	2.25*h*	2.00*h*	1.80*h*	1.20	1.20	.80	1.20	1.20	....	....	[illegible]
Chicago	2.45	2.20	2.05	1.00‡	1.00‡	1.00‡	1.32‡	1.32‡	1.00‡	1.00‡	
Cincinnati	2.53	2.28	2.08	1.20	1.20	1.30	1.80	1.80	....	....	[illegible]
Cleveland	2.45	2.20	....	1.40	1.40	1.30	1.60	1.60	1.65	1.65	[illegible]
Dallas	2.30	2.05	1.85	1.40	1.40	1.05	1.00	1.15	1.84	1.89	[illegible]
Denver	3.08	2.85	....	1.20	1.40	.90	....	....	....	....	[illegible]
Detroit	2.25	2.00	1.80	1.30	1.30	1.00	1.50	1.60	1.15‡	1.25‡	[illegible]
Kansas City	2.55	2.30	2.06	1.85	2.30	1.15	1.85	1.80	....	....	[illegible]
Los Angeles	2.32	2.12	....	1.20	1.20	.90	1.20*f*	1.20*f*	1.05	1.15	[illegible]
Minneapolis	2.86	....	2.41	1.00*h*	1.00*h*	.25*h*	1.00*h*	1.00*h*	....	....	[illegible]
Montreal	....	....	1.70*c*	.80	.85	1.15‡	1.20‡	1.30‡	....	....	[illegible]
New Orleans	2.37	2.12	2.05	1.50	1.50	1.25	....	....	....	....	[illegible]
New York	2.50‡	2.20‡	....	1.10*de*	1.10*de*	.70*de*	1.65*de*	1.75*de*	....	....	[illegible]
Philadelphia	2.55	2.30	2.10	1.55‡	1.65‡	1.25‡	2.00‡	2.05‡	1.00‡	1.00‡	[illegible]
Pittsburgh	2.40	2.15	1.95	1.80‡	1.80‡	2.10‡	2.25‡	2.25‡	1.50	1.50	[illegible]
St. Louis	2.52	2.27	....	1.50‡	1.50‡	1.50‡	.85*h*	.85*h*	.65/.95*g*	.50/.85*g*	[illegible]
San Francisco	2.72	2.52	2.20	1.35	1.35	1.35	1.50	1.50	....	....	[illegible]
Seattle	3.10	2.95	....	1.17	1.17	1.17	1.33	1.33	....	....	[illegible]

‡ Delivered. CEMENT: *a* 10c. allowed for each returnable bag. *b* 10c. per bbl. off for cash. *c* Sales tax included. AGGREGATES: *d* Per cu.yd. *e* Barge lots along-side docks. *f* Crushed granite. *g* F.o.b. granite City, Ill. *h* F.o.b. plant. CONCRETE: *i* Within three miles of Public Square. *j* 5% discount for cash. *k* Discount 35c. 500 to 2000; 70c. 2000 to 5000; 95c. over 5000. *l* Up to 200 cu.yd. *m* 50c. off for cash. *n* 25 c.y. or more.

CASH DISCOUNTS, CEMENT to Contractors: truck delivery, 2% for cash on 10th of month; on carload deliveries, no trucking, same as dealer cash discount, 10c. per bbl. for payment within 15 days of date of invoice, in Montreal 5% if payment before 15th.

CURRENT MAXIMUM PRICES RECEIVED AT CEMENT MILL

Charge for bags not included. For cloth bags, add 40c. per bbl.; 10c. refund allowed for each returnable bag; for paper bags add 15c. per bbl., not refundable.

	Bagged	Bulk		Bagged	Bulk		Bagged	Bulk
Buffington, Ind.	$1.70	$1.65	Ironton, Ohio	$1.50	$1.45	Northampton, Pa.	$1.65	$1.60
Crestmore, Calif.	1.72	....	Iola, Kans.	1.70	1.65	North Birmingham, Ala.	1.75	1.70
Dallas, Tex. (Inc. 5c. tax)	1.80	1.75	La Salle, Ill.	1.70	1.65	Richard City, Tenn.	1.85	1.80
Hannibal, Mo.	1.70	1.65	Limedale, Ind.	1.70	1.65	Steelton, Minn.	1.80	1.75
Hudson, N. Y.	1.75	1.70	Mason City, Ia.	1.70	1.65	Universal, Pa.	1.65	1.60
Independence, Kans.	1.70	1.65	Norfolk, Va.	1.70	1.65	Waco, Tex. (Plus 5c. Tax in Texas)	1.75	1.70

LOWER PENINSULA, MICHIGAN: Uniform carload lot cement price established March, 1937.

PAVING BRICK, BLOCKS, ASPHALT, ROAD OILS—F.O.B. CITY

	PAVING BRICKS AND BLOCKS			PAVING ASPHALT (Per ton, less than 80 penetration)		ASPHALT BINDERS—FLUXES (Per gal., 80–300 penetration)		CUTBACK ASPHALT (Per ton)		ROAD OILS (Per gal.)	ASPHALT EMULSION (Per gal.)	
	Granite per M, lots of 50,000, 4x4x8 in.	Brick per M, 3x4x8½ in., carload lots	Wood per sq. yd., 3½ in. 16-lb. treat	Tank car	Drums	Tank car	Drums	Tank car	Drums	Tank car	Tank car	Drums
Atlanta	$75.00	$38.85	$2.25	$18.20*e*	$23.41*e*	$0.0728*e*	$0.1049*e*	.0768*he*	.1089*he*	$0.0668*e*	$0.0834	$0.0834
Baltimore	130.00	44.00	2.40	17.00	22.00	.075	.10	.09*h*	.125*h*	.....	.....	.....
Birmingham	110.00	25.00	.....	19.00	24.00	.0878	.1128	.10*h*	.137*h*	.....	.06	.....
Boston	75.00	46.50	3.00	17.00	22.00	.07	.095	.09*h*	.12*h*	.075*i*	.095*i*	.125*i*
Chicago	140.00	46.00	2.50	18.00	23.00	17.00*g*	22.00*g*	.07*h*	.11*h*	.045	.095	.135
Cincinnati	112.00	37.50	.....	13.47	17.47	.12	.....	17.00	.....	.051	.078	.....
Cleveland	3.75*a*	37.50	2.85	18.00	21.75	.081	.099	.091*h*	.061*h*	.06	.09	.099
Dallas	.....	32.50	.....	18.80	22.55	.075	.105	19.80	27.00	.055	.085	.135
Denver	.....	27.50	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Detroit	.....	35.00	.....	16.72*f*	21.97*f*	.....	20.10*g*	15.60	20.60	.0535	.1125	.1525
Kansas City	.....	44.00	.....	18.50	23.50	.077	.1075	.077*h*	.107*h*	.057	.11	.15
Los Angeles	.....	50.00	.....	11.00	15.16	11.00*g*	15.16*g*	11.00	.....	.042	.06	.12
Minneapolis	.....	41.25	1.90*d*	21.70	26.70	.098	.137	21.85	34.65	.0638	.....	.....
Montreal	85.00*e*	60.00	3.42	14.00	20.00	.10	.13	.0975*h*	.01125*h*	.0675	.135	.165
New Orleans	100.00	32.00	.....	14.00	17.00	.065	.09	.07*h*	.10*h*	.....	.078	.11
New York	138/143*b*	65.00	2.80	17.00	22.00	.075	.10	.09*h*	.125*h*	.....	.075	.11
Philadelphia	120.00	45.00	.....	15.00	20.00	.06	.085	.065*h*	.095*h*	.055	.07	.10
Pittsburgh	115.00	40.00	.....	19.00	24.00	.077	.1125	.086*h*	.121*h*	.0675	.....	.....
St. Louis	115/130	37.00	.....	19.00	24.00	.075	.11	.08*h*	.115*h*	.0475	.09	.12
San Francisco	.....	70.00	.....	12.00	18.00	12.00*g*	18.00*g*	12.50	23.00	.04	.0575	.117
Seattle	.....	60.00	.....	25.55	25.55	19.50*g*	25.55*g*	15.50	28.50	8.15*g*	0.75	.1325

PAVING BRICK: *a* 4½x6x5½ in. per sq. yd. delivered. *b* 4x5x9 in. aver. *c* Sales tax included. WOOD BLOCKS: *d* 2½ in. 6 to 8-lb. treatment. ASPHALT: *e* Local reduction due to 20% reduction intra-state class freight rates, only Georgia affected. *f* Mexican. *g* Per ton. *h* Per gallon. *Note:* Paving asphalt, tank car or boat, f.o.b. Maurer, N. J., per ton, Bermudez, $25.00; Trinidad, $22.00.

(Continued on second following page)